SOIL SURVEY OF

Centre County, Pennsylvania

United States Department of Agriculture
Soil Conservation Service
In cooperation with
The Pennsylvania State University
College of Agriculture and the
Pennsylvania Department of Environmental Resources
State Conservation Commission

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1965–74. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1975. This survey was made cooperatively by the Soil Conservation Service; The Pennsylvania State University, College of Agriculture; and the Pennsylvania Department of Environmental Resources, State Conservation Commission. It is part of the technical assistance furnished to the Centre County Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodland; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Centre County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Index to mapping units" can be used to find information. It lists all the soils of the county in alphabetic order by map symbol and shows the page where each is described. The capability subclass of each soil is indicated at the end of the soil description. Other information is available in tables—see the Summary of Tables.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the woodland interpretations.

Foresters and others can refer to the section "Woodland," where a table shows the relative suitability of the soils for growing trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the sections "Town and country planning" and "Recreational development."

Engineers and builders can find, under "Engineering uses of the soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and classification of the soils."

Newcomers to Centre County may be especially interested in the section "General soil map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication, and in the section "General nature of the county."

Cover: New homes along rural roads in Nittany Valley between Bellefonte and State College. The soil is Hagerstown silt loam, 3 to 8 percent slopes.

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SOIL SURVEY OF CENTRE COUNTY, PENNSYLVANIA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE, AND THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES, STATE CONSERVATION COMMISSION

CENTRE COUNTY is the geographic center of Pennsylvania (fig. 1). It was formed in 1800 from parts of Huntingdon, Mifflin, Lycoming, and Northumberland counties. Bellefonte was designated as the county seat.

The county has a total area of 1,115 square miles, or 713,600 acres. Census data in 1970 showed a population of 99,267 for the county. State College, with a population of 33,778; Bellefonte, with a population of 6,828; and Philipsburg, with a population of 3,700, were the three largest boroughs in 1970. Many smaller communities are scattered throughout the county.

The northwestern half of the county is in the Allegheny Plateau province, and the southeastern half is in the Valley and Ridge province. Centre County is located in the Susquehanna River basin.

The average annual temperature is 49° F. Winters normally are cold and relatively dry and summers are warm and humid. The elevation ranges from 580 feet to about 2,600 feet.

Farming was the county's only industry until iron ore was discovered in 1784. Operating iron furnaces and farming were the main industries until the beginning of the twentieth century. Industry has since become more diversified, and it now includes the production of limestone products, coal, brass products, electronic components, and lumber.

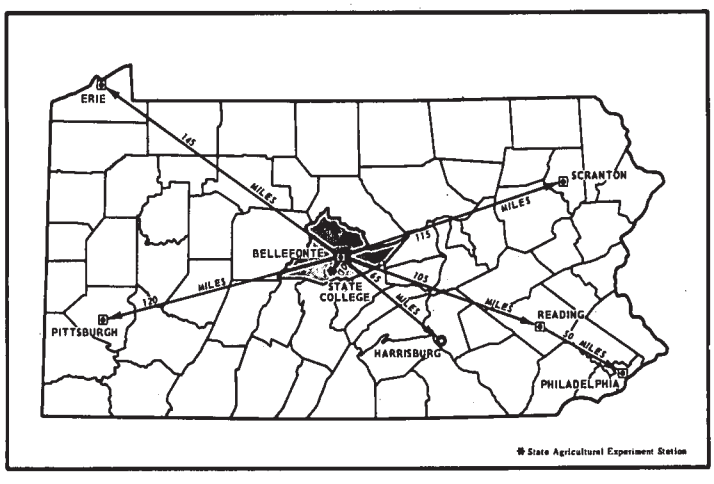

Figure 1.—Location of Centre County in Pennsylvania.

Farming is a major industry in the county. Most farms are in the valleys of the Valley and Ridge province. The limestone and shale in these valleys have weathered to form productive soils. Dairy farming is the main type of farming in the county.

Over the years the number and the size of farms have continued to decrease. Rural nonfarm residents are increasing in number and are responsible for most of the new homes built in rural areas.

The county is easily reached by highway, rail, or air. It is serviced by the Mid-State and the University Park airports and by two railroads. The Keystone Shortway (Interstate 80) runs east-to-west across the county. This highway has greatly facilitated the access to major markets for the county's products by the eight motor freight carriers that serve the area.

Many religious, medical, educational, and recreational facilities are available in Centre County. The Pennsylvania State University was chartered in 1855, and since that time it has experienced steady growth in size and excellence. Recreational facilities include three State parks, several State picnic areas, numerous municipal and private facilities, and about 275 miles of outstanding trout streams. Deer, turkey, and bear are abundant in the county, and they are highly prized by hunters.

Natural resources of limestone, coal, and water are located in various areas of the county. The best grade of high-calcium limestone found in the State is in the Bellefonte area. Bituminous coal is mined extensively in the Philipsburg and Snow Shoe areas. The Big Spring at Bellefonte, which has an average daily flow of 11,500,000 gallons, is the third largest spring in Pennsylvania.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Centre County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock and many facts about the soils. They dug many holes to expose soil profiles. A

profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Hagerstown and Hazleton, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristics that affect use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hagerstown silt loam, 3 to 8 percent slopes, is one of several phases within the Hagerstown series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Centre County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Opequon-Hagerstown complex, steep, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Hazleton-Dekalb association, very steep, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and" Leck Kill and Calvin soils, steep, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous areas and are given descriptive names. Rubble land is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Centre County. A soil association is a landscape that has a distinctive

proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in evaluating large areas as a watershed or a county wide planning for community development, recreation, and open space. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey have been grouped into four general kinds of landscapes for broad interpretative purposes. Each of the broad groups and their included soil associations are described in the following pages. Most of the names and some of the boundaries in the Centre County general soil map do not match those in the earlier Clinton County survey because of changes in the concept of some series and differing soil patterns in adjacent areas.

Soils That Formed in Residual Material Weathered From Sandstone and Shale on the Allegheny Plateau

The two associations in this group are in the northwestern part of the county on the Allegheny Plateau. Most of the soils are well drained, but there are small areas of moderately well drained soils. Narrow flood plains are along streams. Most of the acreage in these associations remains wooded because the soils are commonly stony and are inaccessible in mountainous areas. Extensive strip mining for coal has taken place.

1. Hazleton-Clymer Association

Dominantly gently sloping to very steep, deep, well drained soils underlain by acid sandstone bedrock

This association (fig. 2) is mainly in the northwestern part of the county. Very stony and extremely stony sandy loams dominate. The landscape is an undulating plateau that is dissected by streams in many places.

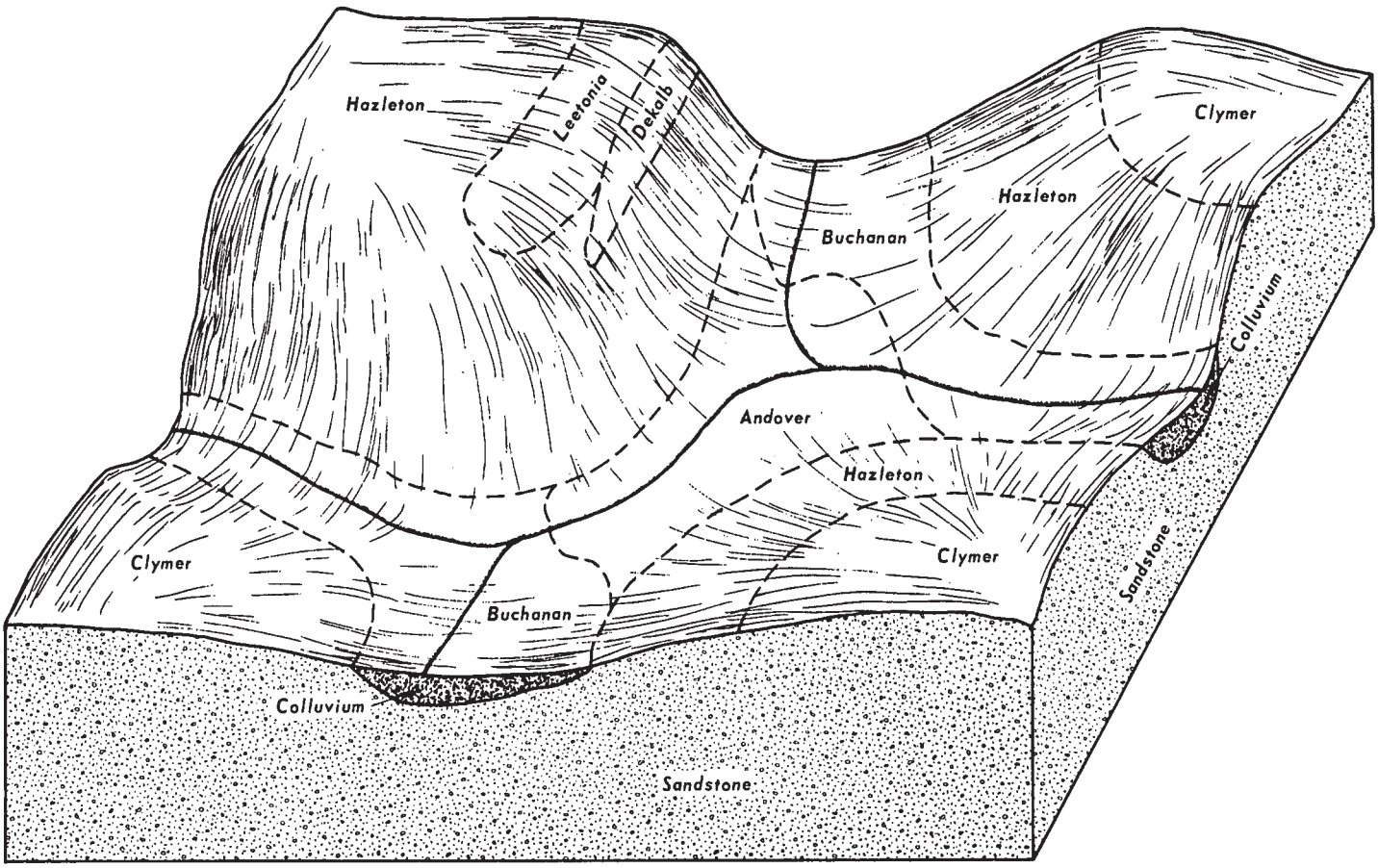

Figure 2.—Typical pattern of soils and underlying material in association 1.

Broad, gently sloping to sloping ridges give way to steep and very steep ravine sides along stream valleys which cut into the plateau.

This association makes up about 28 percent of the county, and it is the most extensive. It is about 45 percent Hazleton soils, 19 percent Clymer soils, and 36 percent soils of minor extent.

Hazleton soils are deep, well drained, nearly level to very steep, and generally extremely stony. Clymer soils are deep, well drained, nearly level to moderately steep, and generally very stony. The soils of minor extent include the deep, moderately well drained Buchanan soils; the deep, well drained Leetonia soils; the moderately steep, well drained Dekalb soils; and the deep, poorly drained Andover soils on uplands.

Most of this association is in woodland. The soils are well suited or very well suited to trees. Large tracts are in State forest and State gameland. Most private acreage is used for woodland production and for wildlife habitat and recreation. A few areas that were once cleared and farmed are now reforested, and the remaining buildings are used for summer homes or hunting camps. The main limitations to most uses are surface stoniness and the areas of steep and very steep soils. Areas used for strip mining of coal are scattered throughout this association.

2. *Wharton-Gilpin-Strip Mines Association*

Dominantly gently sloping and sloping, deep and moderately deep, moderately well drained and well drained soils and strip mines; underlain by acid shale bedrock

This association (fig. 3) consists of several scattered areas in the northwestern part of the county. Silt loams

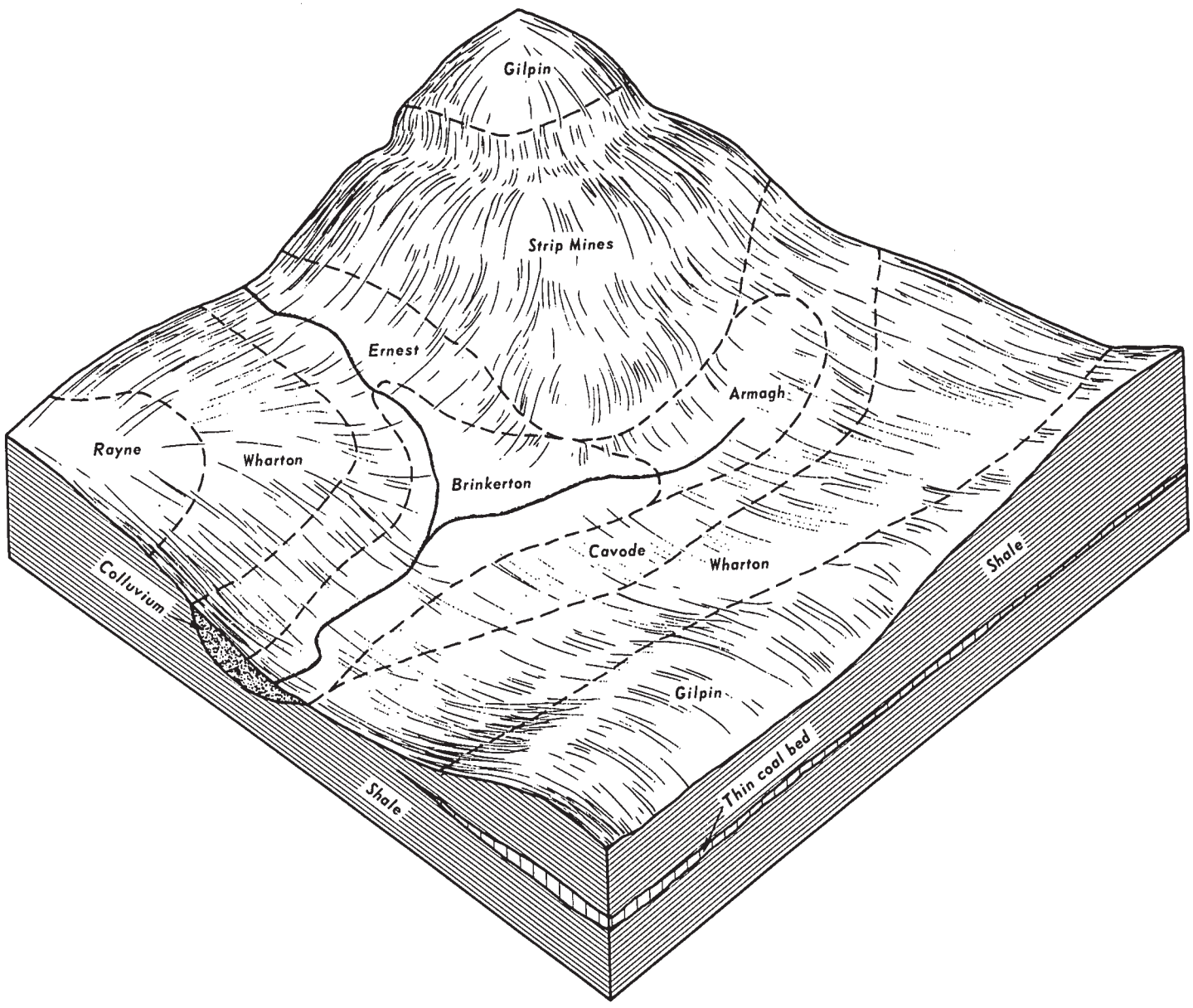

Figure 3.—**Typical pattern of soils and underlying material in association 2.**

and mine spoil dominate. The landscape is an undulating plateau that includes broad, nearly level to moderately steep upland knolls and depressions and areas of nearly level to very steep mine spoil.

This association makes up about 7 percent of the county. It is about 25 percent Wharton soils, 23 percent Gilpin soils, 20 percent areas of Strip mine, and 32 percent soils of minor extent.

Wharton soils are deep, moderately well drained, nearly level to sloping soils that have a moderately slowly permeable subsoil. Gilpin soils are moderately deep to shale bedrock, are well drained, and are gently sloping to moderately steep. Strip mines are areas of soil material and rock fragments that are extremely acid, nearly level to very steep, and extremely variable in composition. They are the overburden that remains after an area has been strip mined for coal or fire clay. The soils of minor extent include the deep, somewhat poorly drained Cavode soils; the deep, poorly drained Armagh and Brinkerton soils; the deep, moderately well drained Ernest soils; and the deep, well drained Rayne soils on uplands.

Most of this association is in woodland and the soils are very well suited to this use. Large tracts are in State forest and State gameland. Most private acreage is used for woodland production and for wildlife habitat and recreation. Some areas that were once cleared and farmed are now reforested, and the remaining buildings are used for summer homes or hunting camps. The varying characteristics of Strip mines make onsite investigation necessary to determine suitability for various uses. The main limitations for most uses are the seasonal high water table of the Wharton soils and the moderate depth to shale bedrock of the Gilpin soils.

Soils That Formed in Residual Material Weathered from Shale of the Valley and Ridge Province

The two associations in this group are on the dominantly acid shale uplands of the Valley and Ridge province in the central and southeastern parts of the county. The soils are generally shaly or channery and are dominantly well drained. Moderately well drained soils generally are on the lower part of slopes, and soils on flood plains are mainly in narrow bands along streams. Most of the acreage of less sloping soils is used for general farming, but the steeper soils are mostly in woodland.

3. *Berks-Weikert Association*

Dominantly sloping to very steep, moderately deep and shallow, well drained soils underlain by acid shale bedrock

This association (fig. 4) consists of a large band along the Bald Eagle Valley (fig. 5) and several scattered small areas in the southeastern part of the county. Shaly silt loams dominate. The landscape is a hilly upland that has been dissected by streams in many places.

This association makes up about 9 percent of the county. It is 51 percent Berks soils, 13 percent Weikert soils, and 36 percent soils of minor extent.

Berks soils are moderately deep, well drained, gently sloping to very steep, and generally shaly. Weikert soils are shallow, well drained, gently sloping to very steep, and generally shaly. The soils of minor extent include the deep, poorly drained Brinkerton soils; the deep, moderately well drained Ernest and Wharton soils; and the moderately deep, poorly drained Markes soils on uplands.

Most of the acreage of the less sloping soils is used for general farming, but droughtiness limits the production of crops. The more sloping soils are in woodland, and they are well suited or suited to this use. The main limitation for most uses is the moderate and shallow depth to rippable shale bedrock.

4. *Leck Kill-Albrights-Meckesville Association*

Dominantly sloping to very steep, deep, well drained and moderately well drained soils underlain by acid shale bedrock

This association consists of one large band that runs diagonally through the county at the base of the Allegheny Front. Channery or very stony silt loams dominate. The landscape is a hilly upland that has been dissected by streams in many places.

This association makes up about 5 percent of the county. It is 60 percent Leck Kill soils, 13 percent Albrights soils, 10 percent Meckesville soils, and 17 percent soils of minor extent.

Leck Kill soils are deep, well drained, nearly level to very steep, and channery or very stony. Albrights soils are deep, moderately well drained, nearly level to moderately steep soils that have a moderately slowly permeable fragipan and are generally very stony. Meckesville soils are deep, well drained, nearly level to moderately steep soils that have a moderately slowly permeable fragipan and are generally very stony. The soils of minor extent include the steep to very steep, moderately deep, well drained Calvin soils and the deep, poorly drained Brinkerton soils on uplands.

Most of the acreage of less sloping soils is used for general farming, and these soils are very well suited or excellently suited to this use. The more sloping soils are forested, and they are well suited or very well suited to this use. The main limitations for most uses are the steepness of Leck Kill soils, the seasonal high water table and moderately slow permeability in the fragipan of the Albrights soils, the moderately slow permeability in the fragipan of the Meckesville soils, and the many surface stones present in most wooded areas.

Soils That Formed in Residual and Colluvial Material Weathered Dominantly from Limestone in Valleys

The five associations in this group are in the dominantly limestone or calcareous shale valleys of the Valley and Ridge province in the central and eastern parts of the county. Small areas of less well drained soils and soils on flood plains are mainly in narrow bands along streams in these associations. Most of the acreage is used for general farming, but most of the Morrison association is in woodland.

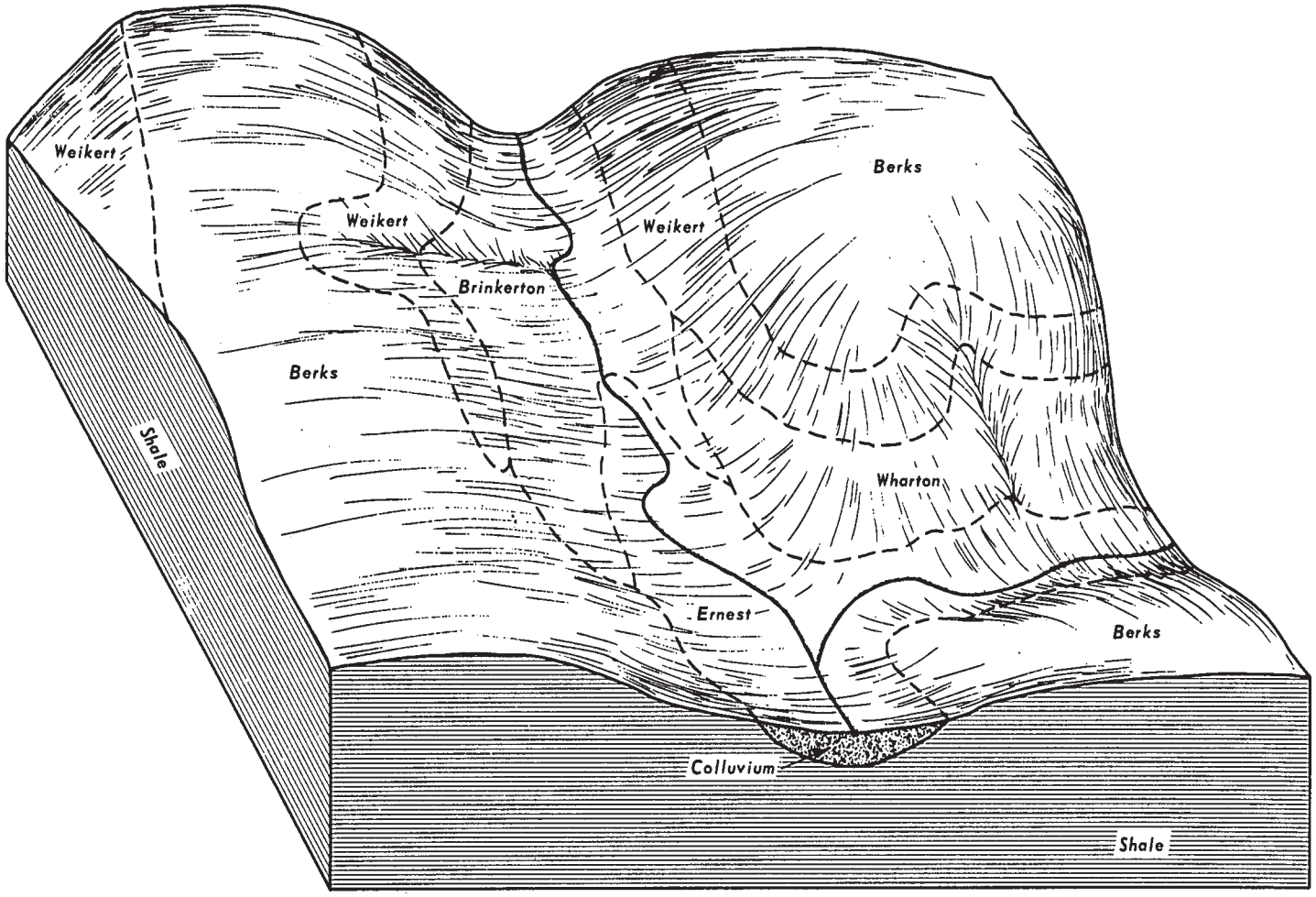

Figure 4.—**Typical pattern of soils and underlying material in association 3.**

5. *Hagerstown-Opequon-Hublersburg Association*

Dominantly nearly level to sloping, deep and shallow, well drained soils underlain by limestone bedrock

This association (fig. 6) is mainly in Nittany Valley and the western part of Penns Valley. Silt loams and silty clay loams dominate. The landscape is an undulating upland that is spotted with scattered sinkholes, which are commonly associated with underground caves.

This association makes up about 12 percent of the county. It is about 53 percent Hagerstown soils, 12 percent Opequon soils, 12 percent Hublersburg soils, and 23 percent soils of minor extent.

Hagerstown soils are deep, dominantly nearly level to moderately steep soils that have a clayey layer in the subsoil. Opequon soils are shallow, dominantly gently sloping to moderately steep soils that have a clayey subsoil. Hublersburg soils are deep, nearly level to moderately steep soils that have a clayey layer in the subsoil. The soils of minor extent include the deep, moderately well drained Clarksburg soils on uplands and the deep, well drained Nolin, local alluvium, soils in lower lying areas.

Most soils of this association are used for general farming, and Hagerstown and Hublersburg soils are excellently suited to farming. Because they are shallow over limestone bedrock and droughty, Opequon soils are only fairly suited to crops. The largest urban areas in the county are in this association. The main limitations for most uses are the clayey subsoil in all of the soils and the shallowness of the Opequon soils. The formation of sinkholes is a hazard throughout the association.

6. *Morrison Association*

Dominantly gently sloping to moderately steep, deep, well drained soils underlain by limy sandstone

This association includes the areas known as the Barrens and Sand Ridge along the northwestern side of Nittany Valley. Sandy loams dominate. The landscape is a rolling upland that has been dissected by intermittent drainageways.

This association makes up about 5 percent of the

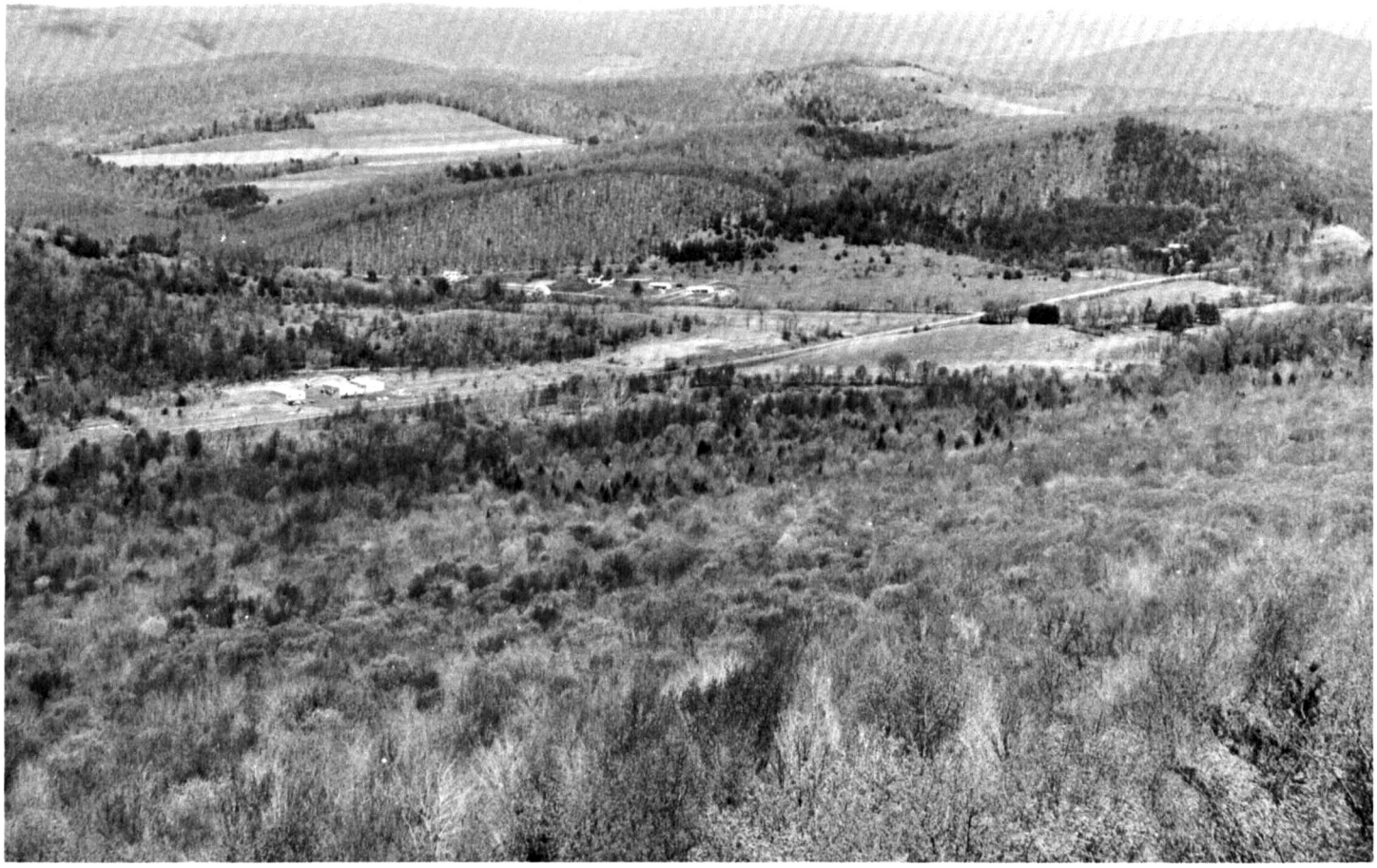

Figure 5.—Typical area in association 3 in the Bald Eagle Valley. The mountain in the background, known as the Allegheny Front, is the boundary between the Valley and Ridge province and the Allegheny Plateau province.

county. It is 80 percent Morrison soils and 20 percent soils of minor extent.

Morrison soils are deep, well drained, and nearly level to very steep; and the steeper soils are generally very stony. The soils of minor extent include the deep, well drained Murrill, Leetonia variant, Hublersburg, and Hagerstown soils on uplands and the deep, somewhat excessively drained Wyoming soils on low terraces along drainageways.

Most of this association is in woodland, and the soils are well suited to this use. The less sloping soils are very well suited and excellently suited to farming. Areas close to urban areas are being developed for residential, commercial, and industrial uses. In the outlying areas, scattered residential developments are steadily increasing. In the past, there was considerable mining and digging for iron ore in this association. The main limitations for most uses are surface stones and steep to very steep slopes.

7. *Opequon-Hagerstown Association*

Dominantly gently sloping and sloping, shallow and deep, well drained soils underlain by limestone bedrock

This association is in Penns Valley. Silty clay loams and silt loams dominate. The landscape is an undulating to rolling upland that consists of parallel ridges of Opequon soils connected by narrow bands of Hagerstown soils. This association is spotted with scattered sinkholes that are generally associated with underground caves.

This association makes up about 3 percent of the county. It is about 35 percent Opequon soils, 23 percent Hagerstown soils, and 42 percent soils of minor extent.

Opequon soils are shallow, well drained, dominantly gently sloping to moderately steep soils that have a clayey subsoil. Hagerstown soils are deep, well drained, dominantly gently sloping to moderately steep soils that have a clayey layer in the subsoil. The soils of minor extent include the deep, well drained Edom and Millheim soils on uplands and the deep, well drained Nolin, local alluvium, soils in lower lying areas.

Most soils of this association are used for general farming. Opequon soils have fair suitability for farming, but Hagerstown soils are excellently suited to crops. The main limitations for most uses are the shallow depth to limestone bedrock and the clayey subsoil of the Opequon soils and the clayey subsoil layer of the Hagerstown soils. The formation of sinkholes is a hazard throughout the association.

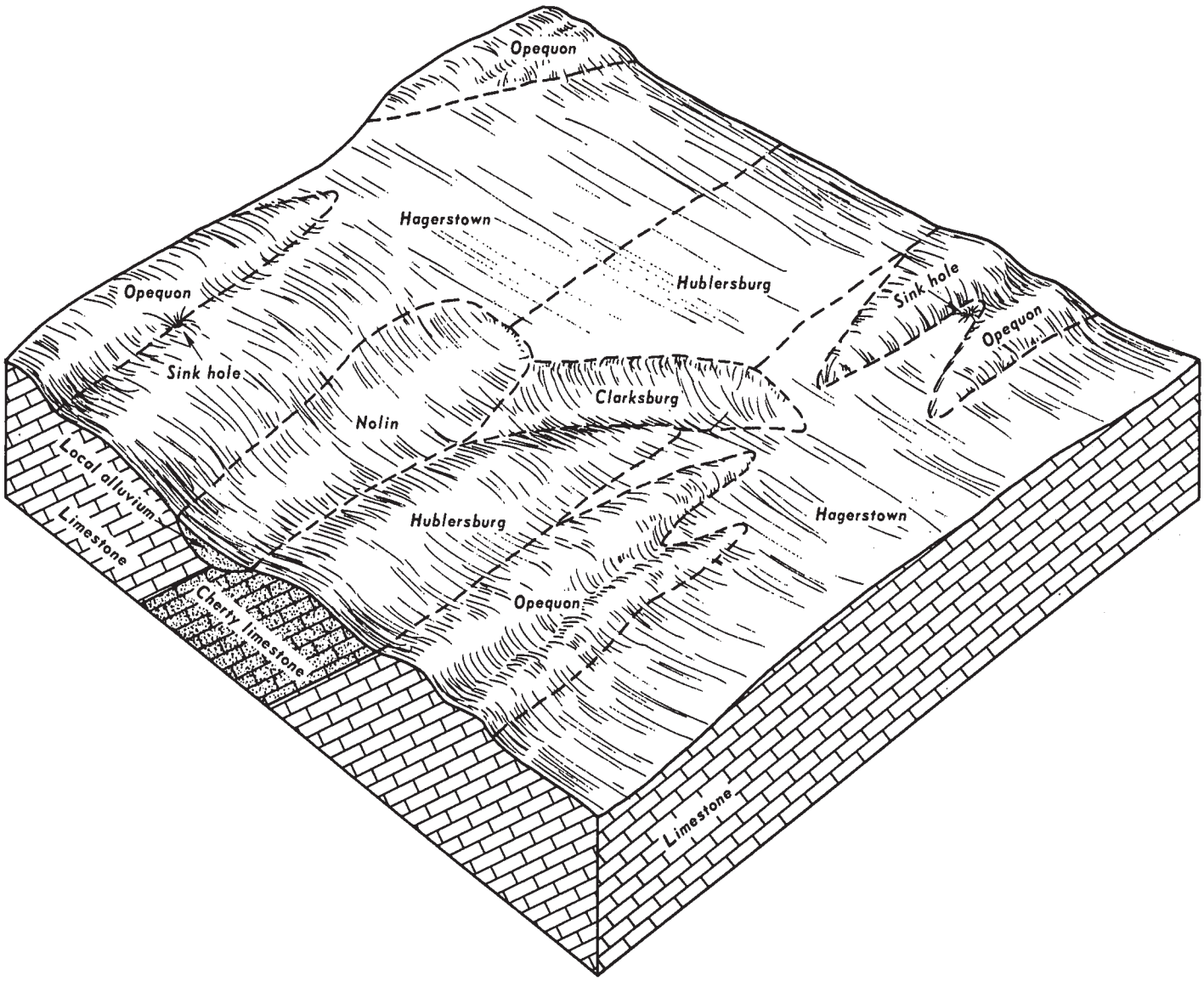

***Figure 6.*—Typical pattern of soils and underlying material in association 5.**

8. Murrill Association

Dominantly nearly level to sloping, deep, well drained soils underlain by limestone bedrock

This association is along the base of mountain ridges at the edge of limestone valleys. Channery silt loams dominate. The landscape is an undulating upland that is spotted with many sinkholes. Commonly, these sinkholes have drainageways emptying into them from mountainsides, and they are frequently associated with underground caves.

This association makes up about 2 percent of the county. It is about 82 percent Murrill soils and 18 percent soils of minor extent.

Murrill soils are deep, well drained, nearly level to moderately steep soils that formed in sandstone colluvium over limestone material. The soils of minor extent include the deep, well drained Hagerstown soils; the shallow, well drained Opequon soils; the deep, well drained Laidig soils; the deep, moderately well drained Buchanan soils; and the deep, poorly drained Andover soils.

Most soils of this association are used for general farming, and they are excellently suited to this use. The main limitations for most uses are the scattered very stony areas and the many sinkholes throughout the association. The active formation and appearance of sinkholes is a hazard.

9. Edom-Millheim Association

Dominantly gently sloping and sloping, deep, well drained soils underlain by nonacid shale bedrock

This association (fig. 7) is mainly in the Penns Val-

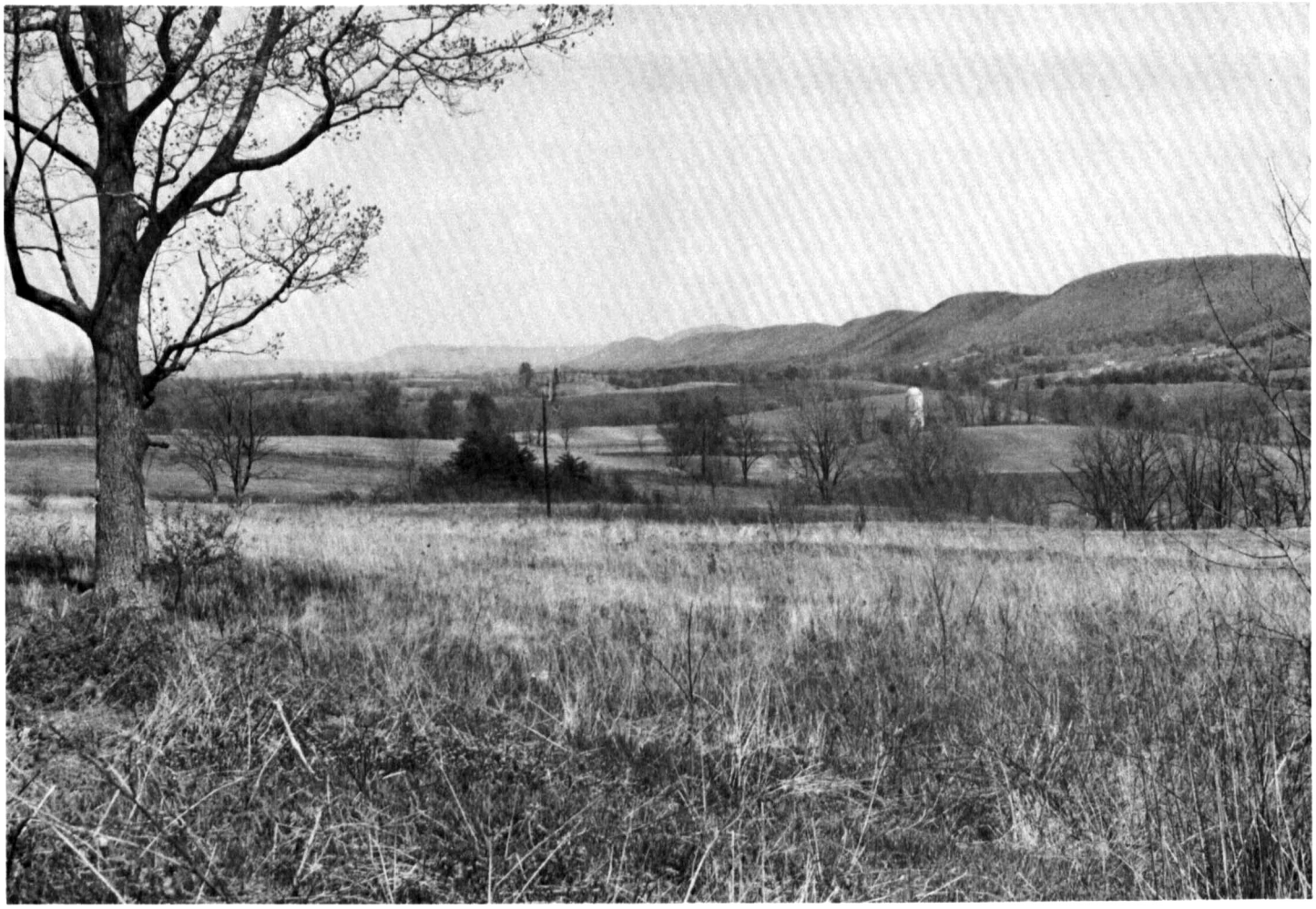

Figure 7.—**Typical landscape of the soils in association 9.**

ley area. Silt loams dominate. The landscape is an undulating to rolling upland that is irregularly dissected by drainageways.

This association makes up about 2 percent of the county. It is 30 percent Edom soils, 27 percent Millheim soils, and 43 percent soils of minor extent.

Edom and Millheim soils are deep, well drained, dominantly gently sloping to moderately steep soils that have a clayey subsoil. Edom soils have a brighter colored subsoil than Millheim soils. The dark subsoil of Millheim soils is caused by the underlying, dark colored carbonaceous shale. The soils of minor extent include the deep, moderately well drained Clarksburg soils; the moderately deep, well drained Berks soils; and the shallow, well drained Weikert and Opequon soils on uplands.

Most soils of this association are used for general farming, and they are well suited or very well suited to this use. The main limitations for most uses are the 3½ to 6 foot depth to rippable shale bedrock and the clayey subsoil. Most of the minor soils have bedrock above a depth of 3½ feet. A few scattered sinkholes have formed.

Soils That Formed in Residual and Colluvial Material Weathered from Sandstone on Ridges

The two associations in this group are in the central and eastern parts of the county dominantly on sandstone ridges and in the mountain valleys. Most of the soils are well drained, but some poorly drained soils are in depressions and on lower foot slopes. The soils are commonly very stony or extremely stony. Soils on flood plains are in narrow bands along streams. Most of the acreage is wooded because of the many surface stones generally present, the many steep slopes, and the inaccessibility in mountains.

10. Hazleton-Laidig-Andover Association

Dominantly gently sloping to very steep, deep, well drained and poorly drained soils underlain by acid sandstone bedrock

In this association (fig. 8), extremely stony and very stony sandy loams and loams dominate. The landscape is dominantly hilly to steep ridges that have narrow

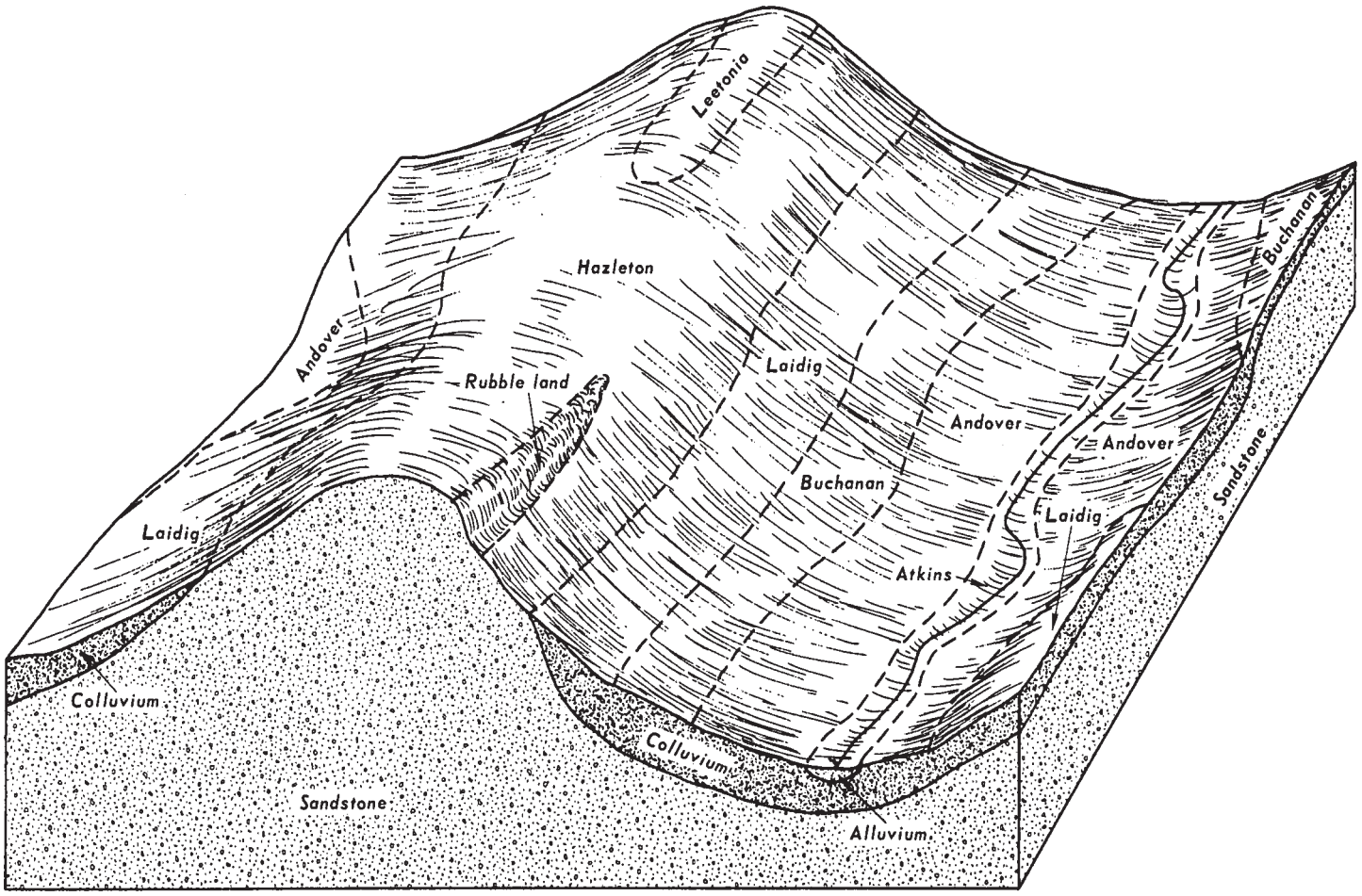

Figure 8.—**Typical pattern of soils and underlying material in association 10.**

valleys between them. Streams generally run parallel to the valleys and ridges, but occasionally they cut through the ridges.

This association makes up about 24 percent of the county. It is 28 percent Hazleton soils, 23 percent Laidig soils, 16 percent Andover soils, and 33 percent soils of minor extent.

Hazleton soils are deep, well drained, nearly level to very steep, and generally extremely stony. Laidig soils are deep, well drained, nearly level to very steep soils that have a fragipan in the lower part of the subsoil and are generally extremely stony. Andover soils are deep, poorly drained, nearly level to sloping soils that have a fragipan in the lower part of the subsoil and in the substratum and are generally very stony. The soils of minor extent include the deep, moderately well drained Buchanan soils; the moderately deep, well drained Dekalb soils; the deep, well drained Clymer and Leetonia soils and Rubble land on uplands; and Atkins soils in lower lying areas.

Most of this association is in woodland, and the soils are well suited to this use. Large tracts are in State forest. Most private acreage is used for woodland and wildlife habitat and recreation. A few areas at the bases of ridges adjacent to the limestone valleys are farmed. Some areas that were once cleared and farmed are now reforested, and most of the remaining buildings are now used for summer homes or hunting camps. The main limitations to most uses are the surface stoniness, the extensive areas of steep to very steep soils, and the moderately slow permeability or slow permeability in the Laidig and Andover soils. Areas of Rubble land are along the sides of ridges and where streams cut through ridges. These areas are nearly 100 percent rock or stone cover and support only very sparse vegetation.

11. Ungers Association

Dominantly gently sloping to moderately steep, deep, well drained soils underlain by acid sandstone bedrock

This association occupies some of the broader mountain valleys scattered throughout the Valley and Ridge province. Very stony loams dominate. The landscape is a rolling upland.

This association makes up about 3 percent of the county. It is 73 percent Ungers soils and 27 percent soils of minor extent.

Ungers soils are deep, well drained, nearly level to moderately steep, and generally very stony. The soils of minor extent include the deep, moderately well drained Albrights soils; the deep, well drained Meckesville soils; and the deep, poorly drained Andover soils on uplands.

Most soils of this association are in woodland, and they are very well suited to this use. Some areas that were once cleared and farmed are now reforested, and the remaining buildings are used for summer homes or hunting camps. The main limitation to most uses is the surface stoniness.

Descriptions of the Soils

In this section the soils of Centre County are described in detail and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section "How this survey was made," not all mapping units are members of a soil series. Rubble land, for example, does not belong to a soil series, but nevertheless is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Suggestions for the use and management of each mapping unit are given in the description of that unit. Listed at the end of each description of a mapping unit is the capability class or subclass in which the mapping unit has been placed.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many terms used in the soil descriptions and in other sections of the survey are defined in the Glossary at the back of this publication. More detailed information about the terminology and methods of soil mapping can be obtained from the "Soil Survey Manual" (*9*).[1]

[1] Italic numbers in parentheses refer to Literature cited, p. 158.

Albrights Series

The Albrights series consists of deep, moderately well drained soils that formed in siltstone, shale, and sandstone colluvium. These nearly level to moderately steep soils occupy concave midslopes and lower foot slopes of mountains.

In a representative profile in woodland, 2 inches of organic material covers a surface layer of very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam 5 inches thick. The upper 21 inches of the subsoil is reddish brown loam and clay loam. It has strong brown and pinkish gray mottles at a depth of 18 inches. The lower part of the subsoil to a depth of 60 inches is a fragipan. It is reddish brown, firm and brittle channery loam. It has strong brown and pinkish gray mottles.

Permeability is moderately slow, and available water capacity is moderate. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods. A fragipan is in the lower part of the subsoil. Most limitations are related to the seasonal high water table, moderately slow permeability, slope, and surface stones in some very stony areas.

About half of the acreage of these soils is in woodland, and most of the rest is in cropland.

Representative profile of Albrights silt loam in an area of Albrights very stony silt loam, 8 to 15 percent slopes, in woodland along T–300, 2 miles northeast of its junction with Pa–350 in Taylor Township:

O1—2 inches to 1 inch; undecomposed hardwood leaf litter.

O2—1 inch to 0; black (5YR 2/1) mostly decomposed organic material.

A1—0 to 1 inch; very dark gray (5YR 3/1) silt loam; weak very fine and fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent coarse fragments; extremely acid; abrupt smooth boundary.

A2—1 inch to 6 inches; brown (7.5YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B1—6 to 18 inches; reddish brown (5YR 5/4) loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B2t—18 to 27 inches; reddish brown (5YR 4/4) clay loam; many medium distinct pinkish gray (7.5YR 6/2) and strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable, sticky and plastic; 10 percent coarse fragments; common faint clay films on ped faces and lining pores; very strongly acid; clear wavy boundary.

Bx1—27 to 36 inches; reddish brown (5YR 4/4) channery loam, gray (5YR 6/1) prism faces; few fine prominent pinkish gray

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Albrights silt loam, 3 to 8 percent slopes	1,710	0.2
Albrights silt loam, 8 to 15 percent slopes	1,240	.2
Albrights very stony silt loam, 0 to 8 percent slopes	820	.1
Albrights very stony silt loam, 8 to 15 percent slopes	1,820	.3
Allegheny silt loam, 2 to 8 percent slopes	500	.1
Andover channery loam, 0 to 8 percent slopes	7,900	1.1
Andover channery loam, 8 to 15 percent slopes	4,340	.6
Andover very stony loam, 0 to 8 percent slopes	8,670	1.2
Andover very stony loam, 8 to 15 percent slopes	12,780	1.8
Armagh silt loam, 0 to 3 percent slopes	770	.1
Armagh silt loam, 3 to 8 percent slopes	1,810	.3
Atkins silt loam	4,260	.6
Basher loam	3,270	.5
Berks shaly silt loam, 3 to 8 percent slopes	1,500	.2
Berks shaly silt loam, 8 to 15 percent slopes	7,110	1.0
Berks shaly silt loam, 15 to 25 percent slopes	10,310	1.4
Berks very stony silt loam, 8 to 25 percent slopes	1,140	.2
Berks and Weikert soils, steep	27,200	3.8
Brinkerton silt loam, 0 to 3 percent slopes	490	.1
Brinkerton silt loam, 3 to 8 percent slopes	3,670	.5
Brinkerton silt loam, 8 to 15 percent slopes	2,230	.3
Brinkerton very stony silt loam, 0 to 8 percent slopes	540	.1
Buchanan loam, 2 to 8 percent slopes	1,780	.2
Buchanan channery loam, 3 to 8 percent slopes	3,270	.4
Buchanan channery loam, 8 to 15 percent slopes	2,600	.4
Buchanan extremely stony loam, 0 to 8 percent slopes	14,830	2.1
Buchanan extremely stony loam, 8 to 25 percent slopes	13,920	1.9
Carlisle muck	680	.1
Cavode silt loam, 0 to 3 percent slopes	350	(1)
Cavode silt loam, 3 to 8 percent slopes	4,320	.6
Chagrin soils	2,030	.3
Clarksburg silt loam, 0 to 3 percent slopes	420	.1
Clarksburg silt loam, 3 to 8 percent slopes	1,270	.2
Clymer sandy loam, 3 to 8 percent slopes	2,720	.4
Clymer sandy loam, 8 to 15 percent slopes	860	.1
Clymer very stony sandy loam, 0 to 8 percent slopes	26,510	3.7
Clymer very stony sandy loam, 8 to 25 percent slopes	10,400	1.4
Dunning silty clay loam	1,770	.2
Edom silt loam, 2 to 8 percent slopes	2,810	.4
Edom silt loam, 8 to 15 percent slopes	1,720	.2
Edom silt loam, 15 to 25 percent slopes	200	(1)
Ernest channery silt loam, 3 to 8 percent slopes	1,320	.2
Ernest channery silt loam, 8 to 15 percent slopes	2,630	.4
Ernest channery silt loam, 15 to 25 percent slopes	510	.1
Ernest very stony silt loam, 3 to 8 percent slopes	330	(1)
Ernest very stony silt loam, 8 to 25 percent slopes	620	.1
Gilpin channery silt loam, 2 to 8 percent slopes	5,800	.8
Gilpin channery silt loam, 8 to 15 percent slopes	4,040	.6
Gilpin channery silt loam, 15 to 25 percent slopes	1,860	.3
Hagerstown silt loam, 0 to 3 percent slopes	4,920	.7
Hagerstown silt loam, 3 to 8 percent slopes	24,270	3.4
Hagerstown silt loam, 8 to 15 percent slopes	2,650	0.4
Hagerstown silty clay loam, 3 to 8 percent slopes	6,260	.9
Hagerstown silty clay loam, 8 to 15 percent slopes	2,200	.3
Hagerstown silty clay loam, 15 to 25 percent slopes	620	.1
Hazleton channery sandy loam, 3 to 8 percent slopes	2,510	.3
Hazleton channery sandy loam, 8 to 15 percent slopes	1,700	.2
Hazleton channery sandy loam, 15 to 25 percent slopes	310	(1)
Hazleton extremely stony sandy loam, gently sloping	34,680	4.9
Hazleton extremely stony sandy loam, moderately steep	43,220	6.1
Hazleton-Dekalb association, very steep	95,680	13.4
Hublersburg silt loam, 0 to 3 percent slopes	670	.1
Hublersburg silt loam, 3 to 8 percent slopes	8,850	1.2
Hublersburg silt loam, 8 to 15 percent slopes	1,480	.2
Hublersburg silt loam, 15 to 25 percent slopes	320	(1)
Laidig channery loam, 3 to 8 percent slopes	660	.1
Laidig channery loam, 8 to 15 percent slopes	1,330	.2
Laidig channery loam, 15 to 25 percent slopes	1,040	.1
Laidig extremely stony loam, 0 to 8 percent slopes	2,830	.4
Laidig extremely stony loam, 8 to 25 percent slopes	28,580	4.0
Laidig extremely stony loam, steep	14,420	2.0
Leck Kill channery silt loam, 3 to 8 percent slopes	1,170	.2
Leck Kill channery silt loam, 8 to 15 percent slopes	4,890	.7
Leck Kill channery silt loam, 15 to 25 percent slopes	6,320	.9
Leck Kill very stony silt loam, 0 to 8 percent slopes	240	(1)
Leck Kill very stony silt loam, 8 to 25 percent slopes	2,380	.3
Leck Kill and Calvin soils, steep	15,910	2.2
Leetonia extremely stony loamy sand, 0 to 12 percent slopes	14,960	2.1
Leetonia sand, variant, 3 to 8 percent slopes	540	.1
Leetonia sand, variant, 8 to 15 percent slopes	420	.1
Lindside soils	3,870	.5
Markes silt loam, 2 to 10 percent slopes	310	(1)
Meckesville silt loam, 3 to 8 percent slopes	510	.1
Meckesville silt loam, 8 to 15 percent slopes	1,550	.2
Meckesville very stony silt loam, 0 to 8 percent slopes	380	.1
Meckesville very stony silt loam, 8 to 25 percent slopes	1,920	.3
Melvin silt loam	4,790	.7
Millheim silt loam, 2 to 8 percent slopes	1,680	.2
Millheim silt loam, 8 to 15 percent slopes	2,000	.3
Millheim silt loam, 15 to 25 percent slopes	310	(1)
Monongahela silt loam, 2 to 8 percent slopes	430	.1
Morrison sandy loam, 2 to 8 percent slopes	9,010	1.2
Morrison sandy loam, 8 to 15 percent slopes	8,500	1.2
Morrison sandy loam, 15 to 25 percent slopes	1,110	.2
Morrison very stony sandy loam, 0 to 8 percent slopes	2,010	.3
Morrison very stony sandy loam, 8 to 25 percent slopes	6,000	.8
Morrison very stony sandy loam, steep	2,250	.3

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Murrill channery silt loam, 0 to 3 percent slopes	1,610	.2	Rubble land	7,340	1.0
Murrill channery silt loam, 3 to 8 percent slopes	9,120	1.3	Strip mines, acid	13,210	1.9
Murrill channery silt loam, 8 to 15 percent slopes	2,300	.3	Tyler silt loam	430	.1
Murrill channery silt loam, 15 to 25 percent slopes	170	(1)	Ungers channery loam, 3 to 8 percent slopes	1,890	.3
Murrill very stony silt loam, 0 to 8 percent slopes	1,430	.2	Ungers channery loam, 8 to 15 percent slopes	1,970	.3
Murrill very stony silt loam, 8 to 25 percent slopes	460	.1	Ungers channery loam, 15 to 25 percent slopes	400	.1
Nolin silt loam, local alluvium, 0 to 5 percent slopes	4,700	.6	Ungers very stony loam, 0 to 8 percent slopes	2,820	.4
Opequon-Hagerstown complex, 3 to 8 percent slopes	12,760	1.8	Ungers very stony loam, 8 to 25 percent slopes	9,390	1.3
Opequon-Hagerstown complex, 8 to 15 percent slopes	12,320	1.7	Urban land-Hagerstown complex, gently sloping	2,360	.3
Opequon-Hagerstown complex, 15 to 25 percent slopes	4,500	.6	Vanderlip loamy sand, 5 to 20 percent slopes	330	(1)
Opequon-Hagerstown complex, steep	2,650	.4	Weikert shaly silt loam, 5 to 15 percent slopes	2,650	.4
Opequon-Rock outcrop complex, 0 to 8 percent slopes	1,100	.2	Weikert shaly silt loam, 15 to 25 percent slopes	1,780	.2
Opequon-Rock outcrop complex, 8 to 25 percent slopes	2,140	.3	Wharton silt loam, 0 to 3 percent slopes	360	.1
Philo loam	2,550	.4	Wharton silt loam, 3 to 8 percent slopes	11,570	1.6
Philo and Atkins very stony soils	6,850	1.0	Wharton silt loam, 8 to 15 percent slopes	1,980	.3
Pope soils	1,430	.2	Wyoming gravelly sandy loam, rarely flooded, 0 to 5 percent slopes	930	.1
Purdy silt loam	470	.1	Quarries and areas of water	550	.1
Rayne silt loam, 2 to 10 percent slopes	770	.1	Total	713,600	100.0

[1] Less than 0.05 percent.

(7.5YR 6/2) and strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure parting to weak thin platy; firm, brittle, slightly sticky and slightly plastic; 20 percent coarse fragments; common faint clay films on ped faces and lining pores; very strongly acid; clear wavy boundary.

Bx2—36 to 60 inches; reddish brown (2.5YR 4/4) channery loam, gray (5YR 6/1) prism faces; few fine prominent pinkish gray (7.5YR 6/2) and strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure parting to weak thin platy; firm, brittle, slightly sticky and slightly plastic; 30 percent coarse fragments; few faint clay films on ped faces and lining pores; very strongly acid.

The solum is 48 to 65 inches or more thick. Depth to bedrock is more than 5 feet. Depth to the fragipan is 20 to 32 inches. Content of coarse fragments ranges from 5 to 30 percent in the upper part of the solum and from 10 to 40 percent in the fragipan. If these soils are not limed, reaction ranges from extremely acid to strongly acid in the upper part of the solum and from very strongly acid to slightly acid in the lower part.

In undisturbed areas, these soils have a thin, black (5YR 2/1) to dark reddish brown (5YR 3/2) A1 horizon that is generally covered by a thin black (5YR 2/1) organic horizon. The Ap horizon, if present, is dark reddish brown (5YR 3/2) to brown (7.5YR 5/4). The Bx horizon is mainly weak red (2.5YR 4/2) to yellowish red (5YR 5/6). Mottles are below a depth of 12 to 20 inches. The B horizon above the fragipan is silty clay loam to clay loam, and the Bx horizon is loam in places.

Albrights soils are associated with the deep, well drained Meckesville, Leck Kill, and Ungers soils; the moderately deep, well drained Calvin soils; and the deep, poorly drained Brinkerton soils.

AbB—Albrights silt loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on uplands. Areas generally range from 2 to 30 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Albrights soils, of Albrights soils that have more than 15 percent coarse fragments in the surface layer, and of soils that have grayish mottles between depths of 12 and 18 inches. Small areas of Meckesville, Leck Kill, Brinkerton, and Ungers soils are also included.

Most of the acreage is used for crops. This soil is very well suited to crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Stripcropping and using diversion terraces and waterways help to control erosion,

retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and moderately slow permeability. Capability subclass IIe.

AbC—Albrights silt loam, 8 to 15 percent slopes. This sloping soil is in concave areas on uplands. Areas generally range from 2 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Albrights soils and a few small areas of Albrights soils that have more than 15 percent coarse fragments in the surface layer. Small areas of Meckesville, Leck Kill, and Ungers soils are also included.

Most of the acreage is used for pasture or crops. This soil is well suited to these uses. Alfalfa and winter grain are affected by frost heaving. Because of slope and erodibility, stripcropping and using diversion terraces and waterways are necessary to control erosion and retain soil nutrients.

Most limitations are caused by slope, erodibility, the seasonal high water table, and moderately slow permeability. Capability subclass IIIe.

AcB—Albrights very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in concave areas on uplands. Areas generally range from 2 to 40 acres in size. Runoff is slow to medium. From 3 to 10 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of sloping or nonstony Albrights soils and of soils that have grayish mottles between depths of 12 and 18 inches. Small areas of Meckesville, Leck Kill, Ungers, and Brinkerton soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult. If cleared of trees, the soil is suited to unimproved pasture.

Most limitations are caused by surface stoniness, the seasonal high water table, and moderately slow permeability. Capability subclass VIs.

AcC—Albrights very stony silt loam, 8 to 15 percent slopes. This sloping soil is in concave areas on uplands. Areas generally range from 2 to 40 acres in size. Runoff is medium to rapid. From 3 to 10 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or nonstony Albrights soils. Small areas of Meckesville, Leck Kill, and Ungers soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult. If cleared of trees, the soil is suited to unimproved pasture.

Most limitations are caused by slope, surface stoniness, the seasonal high water table, and moderately slow permeability. Capability subclass VIs.

Allegheny Series

The Allegheny series consists of deep, well drained soils that formed in old alluvium washed from uplands underlain by sandstone, siltstone, and shale. These nearly level to gently sloping soils are on terraces above flood plains along major streams.

In a representative profile in a cultivated area, the surface layer is dark grayish brown silt loam about 11 inches thick. The subsoil is brown silt loam and clay loam 22 inches thick. The substratum is dark yellowish brown gravelly loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. Most limitations are related to the variability of the texture of the substratum and the variability in depth to the substratum.

Most of the acreage of these soils is in cropland.

Representative profile of Allegheny silt loam, 2 to 8 percent slopes, in cropland, along U.S. 220, 1.4 miles northeast of its junction with U.S. 322 in Houston Township:

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine and fine granular structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; neutral; abrupt smooth boundary.

B21—11 to 18 inches; brown (7.5YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; slightly acid; gradual wavy boundary.

B22t—18 to 26 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; common faint clay films on ped faces and in pores; medium acid; clear wavy boundary.

B23t—26 to 33 inches; brown (7.5YR 4/4) clay loam; weak and moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; common faint clay films on ped faces and many moderate clay films in pores; strongly acid; clear wavy boundary.

C—33 to 60 inches; dark yellowish brown (10YR 4/4) gravelly loam; massive; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; common faint clay films in pores; few fine distinct black coatings on clod surfaces; very strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 6 feet. Content of rounded coarse fragments ranges from 0 to 15 percent in the solum and to 35 percent in the C horizon. If these soils are not limed, reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon is brown (7.5YR 4/2) to yellowish brown (10YR 5/4). The B horizon is brown (10YR 4/3) to strong brown (7.5YR 5/6). It is silt loam, loam, or clay loam. The C horizon is generally similar

to the B horizon in color. It is gravelly sandy loam to clay loam.

Allegheny soils are on the same terrace positions as the deep, moderately well drained Monongahela soils; the deep, somewhat poorly drained Tyler soils; and the deep, poorly drained Purdy soils. Allegheny soils are similar in drainage to the Pope soils on flood plains. They have more clay in the B horizon than Pope soils, and they are not subject to flooding.

AlB—Allegheny silt loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is in mostly convex areas of terraces along major streams. Areas generally range from 2 to 20 acres in size. Runoff is slow to medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of more sloping Allegheny soils, of soils that are similar to Allegheny soils but that have more than 15 percent coarse fragments in the surface layer and subsoil, and of soils that have a redder subsoil. Small areas of Monongahela, Tyler, and Pope soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping and using diversion terraces help to control erosion and retain soil nutrients.

Most limitations are caused by the variability of the substratum. Capability subclass IIe.

Andover Series

The Andover series consists of deep, poorly drained soils that formed in sandstone, siltstone, and shale colluvium. These nearly level to sloping soils are on concave midslopes and lower foot slopes along the base of mountains and in depressions at the heads of drainageways in mountains.

In a representative profile in woodland, 1 inch of organic material covers a surface layer of very dark grayish brown channery loam about 2 inches thick. The subsurface layer is dark grayish brown channery loam 2 inches thick. The upper 19 inches of the subsoil is light brownish gray and light olive brown channery loam and channery clay loam that has yellowish red and strong brown mottles. The lower 21 inches of the subsoil is a fragipan of very firm and brittle, gray and yellowish brown gravelly clay loam that has yellowish red, gray, and strong brown mottles. The substratum is also a fragipan of firm and brittle, gray and yellowish brown gravelly sandy clay loam that has red and light gray mottles.

Permeability is slow, and available water capacity is moderate. A high water table is at a depth of 0 to ½ foot during wet periods. A fragipan is in the lower part of the subsoil and in the substratum. Most limitations are related to the high water table, slow permeability, slope, and surface stones in some very stony areas.

Most of the acreage of these soils is in woodland.

Representative profile of Andover channery loam in an area of Andover very stony loam, 0 to 8 percent slopes, in woodland, 4 miles south of Nittany and one-half mile south of Krisland Church camp along Pa–445 in Miles Township:

O2—1 inch to 0; black (10YR 2/1) partly decomposed organic material.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) channery loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; strongly acid; clear smooth boundary.

A2—2 to 4 inches; dark grayish brown (2.5Y 4/2) channery loam; weak medium platy and weak medium granular structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; strongly acid; clear wavy boundary.

B1g—4 to 10 inches; light brownish gray (2.5Y 6/2) channery loam; common medium prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 20 percent coarse fragments; few faint clay films in pores; strongly acid; clear smooth boundary.

B21tg—10 to 17 inches; light brownish gray (2.5Y 6/2) ped faces, light olive brown (2.5Y 5/4) ped interiors of channery loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable, slightly sticky and slightly plastic; 25 percent coarse fragments; common prominent clay films on ped faces; few fine distinct black coatings on ped faces; very strongly acid; clear smooth boundary.

B22tg—17 to 23 inches; light brownish gray (2.5Y 6/2) ped faces, light olive brown (2.5Y 5/4) ped interiors of channery clay loam; common medium prominent yellowish red (5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine angular blocky structure; firm, slightly sticky and slightly plastic; 25 percent coarse fragments; many moderate clay films on ped faces and in pores; common fine prominent black coatings on ped faces; very strongly acid; abrupt wavy boundary.

Bx1g—23 to 29 inches; gray (10YR 6/1) prism and ped faces, yellowish brown (10YR 5/6) interiors of gravelly clay loam; common medium prominent yellowish red (5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm, brittle, slightly sticky and slightly plastic; 25 percent coarse fragments; common moderate clay films on ped faces and in pores; common fine prominent black coatings on ped faces; very strongly acid; clear smooth boundary.

Bx2g—29 to 44 inches; gray (10YR 6/1) prism and plate faces, yellowish brown (10YR 5/4) interiors of gravelly clay loam; common medium prominent gray (N 6/0) mottles and common fine distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting

to moderate medium platy; very firm, brittle, slightly sticky and slightly plastic; 40 percent coarse fragments; common prominent clay films on plate faces; few fine distinct black coatings on ped faces; very strongly acid; clear smooth boundary.

Cx—44 to 60 inches; gray (10YR 6/1) prism faces, yellowish brown (10YR 5/4) interiors of gravelly sandy clay loam; common medium distinct light gray (N 7/0) and red (2.5YR 4/6) mottles; weak very coarse prismatic structure; firm, brittle, slightly sticky and slightly plastic; 40 percent coarse fragments; very strongly acid.

The solum ranges from 40 to 55 inches in thickness. Depth to bedrock ranges from 4 to 20 feet or more. Depth to the fragipan ranges from 18 to 28 inches. Content of coarse fragments ranges from 10 to 30 percent in the upper part of the solum and from 15 to 40 percent in the Bx and Cx horizons. If these soils are not limed, reaction is very strongly acid or strongly acid throughout.

In undisturbed areas, the A1 horizon is thin and is black (N 2/0) to very dark grayish brown (10YR 3/2). The A2 horizon is dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2). If present, the Ap horizon is very dark grayish brown (10YR 3/2) to olive brown (2.5Y 4/4). The B horizon is dark gray (N 4/0) to light brownish gray (10YR 6/2). Peds and prisms in the Bx horizon have gray (10YR 6/0) to dark grayish brown (2.5Y 4/2) faces and brown (10YR 4/3) to yellowish brown interiors. The Bx horizon is loam, clay loam, or sandy clay loam and is gravelly or channery. The Cx horizon is similar to the B horizon in color. It is gravelly or channery sandy clay loam, loam, or sandy loam.

Andover soils are closely associated with the deep, well drained Laidig soils and the deep, moderately well drained Buchanan soils. They are near the deep, well drained Hazleton and Clymer soils in the mountains and the deep, well drained Murrill soils along the edges of the limestone valleys.

AnB—Andover channery loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in concave areas on uplands. Areas generally range from 3 to 60 acres in size. Runoff is slow to medium, and the erosion hazard is slight to moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation in most places.

Included with this soil in mapping are a few small areas of sloping, nonchannery, or very stony Andover soils. Also included are a few small areas of soils that are similar to Andover soils but that have no mottles above a depth of 12 inches and of wetter soils that have a black surface layer. Small areas of Buchanan, Laidig, Clymer, and Murrill soils are also included.

Most of the acreage is in permanent hay or pasture or is idle. The soil is well suited to woodland and is suited to pasture and crops if drainage is adequate. Stripcropping and using diversion terraces and waterways help to lower the high water table, control erosion, and retain soil nutrients.

Most limitations are caused by the high water table and slow permeability. Capability subclass IVw.

AnC—Andover channery loam, 8 to 15 percent slopes. This sloping soil is in concave areas on uplands. Areas generally range from 2 to 40 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation in most places.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, nonchannery, or very stony Andover soils. Also included are a few small areas of soils that are similar to Andover soils but that have no mottles above a depth of 12 inches. Small areas of Buchanan, Laidig, and Murrill soils are also included.

Most of the acreage is in permanent hay or pasture or is idle. The soil is well suited to woodland and is suited to pasture and crops if drainage is adequate. Stripcropping and using diversion terraces and waterways help to lower the high water table, control erosion, and retain soil nutrients if the soil is cultivated.

Most limitations are caused by the high water table, slope, and slow permeability. Capability subclass IVw.

AoB—Andover very stony loam, 0 to 8 percent slopes. This nearly level and gently sloping soil is in concave areas on uplands. Areas generally range from 5 to 100 acres in size. Runoff is slow to medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of sloping and extremely stony Andover soils. Also included are a few small areas of soils that are similar to Andover soils but that have no mottles above a depth of 12 inches and a few areas of wetter soils that have a black surface layer. Small areas of Buchanan, Clymer, and Murrill soils are also included.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. The very stony surface and high water table make the soil better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness, the high water table, and slow permeability. Capability subclass VIIs.

AoC—Andover very stony loam, 8 to 15 percent slopes. This sloping soil is in concave areas on uplands. Areas generally range from 5 to 100 acres in size. Runoff is medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but generally has more coarse fragments throughout.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or extremely stony Andover soils. Also included are a few small areas of soils that are similar to Andover soils but that have no mottles above a depth of 12 inches. Small areas of Buchanan, Laidig, and Murrill soils are also included.

Nearly all the acreage is in woodland. This soil is well suited to woodland. The very stony surface and high water table make this soil better suited to woodland,

wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness, slope, the high water table, and slow permeability. Capability subclass VIIs.

Armagh Series

The Armagh series consists of deep, poorly drained soils that formed in clay shale and siltsone residuum interbedded with thin layers of coal. These nearly level and gently sloping soils are in concave positions on uplands.

In a representative profile in woodland, 3 inches of organic material covers a surface layer of black silt loam about 2 inches thick. The subsurface layer is gray silt loam 6 inches thick. The subsoil is 30 inches thick. It is light brownish gray, grayish brown, gray, and dark grayish brown silty clay loam and shaly silty clay loam that has strong brown, brown, and gray mottles. The substratum is dark gray shaly loam 6 inches thick. Shale bedrock interbedded with thin layers of coal is at a depth of 44 inches.

Permeability is slow, and available water capacity is moderate to high. A high water table is at a depth of 0 to ½ foot during wet periods, and ponding occurs in places. Most limitations are related to the high water table, slow permeability, and occasional ponding of water.

Most of the acreage of these soils is in woodland.

Representative profile of Armagh silt loam, 0 to 3 percent slopes, in woodland, north of a trail, 370 feet west of its junction with Kato Road, 4.0 miles northeast of Clarence in Snow Shoe Township:

O1—3 inches to 1 inch; undecomposed hardwood leaf litter.

O2—1 inch to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 2 inches; black (10YR 2/1) silt loam; weak very fine and fine granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—2 to 8 inches; gray (10YR 5/1) silt loam; weak very fine subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

B21tg—8 to 15 inches; light brownish gray (2.5Y 6/2) ped faces, grayish brown (2.5Y 5/2) ped interiors of silty clay loam; common fine and medium distinct strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate fine and medium angular blocky; friable, sticky and plastic; 5 percent coarse fragments; common faint and moderate clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

B22tg—15 to 20 inches; gray (10YR 5/1) silty clay loam; common fine and medium faint gray (N 5/0) mottles and common fine and medium prominent brown (7.5YR 4/4) mottles; moderate very coarse prismatic structure parting to moderate fine and medium angular blocky; friable, sticky and plastic; 10 percent coarse fragments; common moderate clay films on ped faces and in pores; very strongly acid; gradual wavy boundary.

B23tg—20 to 38 inches; gray (N 5/0) ped faces, dark grayish brown (10YR 4/2) shaly silty clay loam; few fine distinct brown (7.5YR 4/4) mottles; moderate very coarse prismatic structure parting to moderate medium angular blocky; friable, sticky and plastic; 15 percent coarse fragments; common moderate clay films on ped faces and in pores; very strongly acid; clear smooth boundary.

Cg—38 to 44 inches; dark gray (10YR 4/1) shaly loam; massive; friable, slightly sticky and slightly plastic; 20 percent coarse fragments; common faint clay films in pores and on shale fragments; very strongly acid; clear smooth boundary.

R—44 inches; dark gray (10YR 4/1) shale bedrock and thin interbedded layers of coal.

The solum is 30 to 50 inches thick. Depth to bedrock is 40 to 72 inches. Content of coarse fragments ranges from 0 to 15 percent in the upper part of the solum, 5 to 25 percent in the lower part of the solum, and 10 to 80 percent in the C horizon. If these soils are not limed, reaction is strongly acid or very strongly acid throughout.

The Ap horizon, if present, is very dark gray (10YR 3/1) to grayish brown (2.5Y 5/2). The B horizon is dark grayish brown (10YR 4/2) to light gray (N 7/0) and is mottled. It is dominantly silty clay loam, silty clay, or clay. The lower part of the B horizon is shaly in places. The C horizon is light gray (N 7/0) to brown (10YR 4/3) or yellowish brown (10YR 5/4). It is silty clay to loam and is shaly or very shaly.

Armagh soils are associated with the deep, somewhat poorly drained Cavode soils; the deep, moderately well drained Wharton soils; the deep, well drained Rayne soils; and the moderately deep, well drained Gilpin soils. Armagh soils are similar in drainage to Brinkerton soils. They contain more clay in the B horizon than Brinkerton soils and lack the fragipan that is characteristic of those soils.

ArA—Armagh silt loam, 0 to 3 percent slopes. This nearly level soil is in flat to concave areas on uplands. Areas generally range from 3 to 50 acres in size. Runoff is slow, and occasional ponding occurs during wet periods. The erosion hazard is slight. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping and very stony Armagh soils, of wetter soils, and of soils that are similar to Armagh soils but that have less clay in the subsoil. Small areas of Cavode, Brinkerton, and Wharton soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. Because this soil is inaccessible in the mountainous areas and because the water table is high and permeability is slow, very little of the acreage is cultivated.

Most limitations are caused by the high water table,

occasional flooding, and slow permeability. Capability subclass IVw.

ArB—Armagh silt loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on uplands. Areas generally range from 3 to 60 acres in size. Runoff is slow to medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Armagh soils. Also included are a few small areas of wetter soils and of soils that are similar to Armagh soils but that have less clay in the subsoil. Small areas of Cavode, Brinkerton, and Wharton soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. Because this soil is inaccessible in the mountainous areas and because the water table is high and permeability is slow, very little of the acreage is cultivated.

Most limitations are caused by the high water table and slow permeability. Capability subclass IVw.

Atkins Series

The Atkins series consists of deep, poorly drained soils that formed in alluvium washed from uplands underlain by shale, siltstone, and sandstone. These nearly level soils are on flood plains.

In a representative profile the surface layer is very dark brown silt loam about 2 inches thick. The subsurface layer is 5 inches thick. It is grayish brown silt loam that has dark yellowish brown mottles. The upper 16 inches of the subsoil is grayish brown, gray, and light gray silty clay loam and clay loam that has yellowish brown mottles. The lower 21 inches is gray and dark grayish brown loam and gravelly loam that has yellowish brown and gray mottles. The substratum is dark grayish brown and yellowish brown stratified gravelly loam and gravelly sandy loam to a depth of 61 inches.

Permeability is moderately slow to slow, and available water capacity is high. A high water table is at a depth of 0 to ½ foot during wet periods, and flooding is frequent. Most limitations are related to frequent flooding and the high water table.

Most of the acreage of these soils is in pasture or woodland. Some small areas are in cropland.

Representative profile of Atkins silt loam in an old field, 110 feet northwest of L.R. 14037, 0.6 mile northeast of Philipsburg State General Hospital in Rush Township:

A1—0 to 2 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; very strongly acid; abrupt smooth boundary.

A2—2 to 7 inches; grayish brown (10YR 5/2) silt loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; very strongly acid; clear smooth boundary.

B21g—7 to 15 inches; gray (10YR 6/1) ped faces, grayish brown (2.5Y 5/2) ped interiors of silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable, sticky and slightly plastic; very strongly acid; gradual wavy boundary.

B22g—15 to 23 inches; light gray (N 6/0) ped faces, gray (5Y 5/1) ped interiors of clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; very strongly acid; gradual wavy boundary.

B23g—23 to 35 inches; gray (5Y 5/1) loam; common fine and medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B24g—35 to 44 inches; dark grayish brown (10YR 4/2) gravelly loam; many medium distinct gray (5Y 5/1) mottles and few fine distinct yellowish brown (10YR 5/4) mottles; weak thick platy structure parting to weak fine subangular blocky; firm, slightly sticky and slightly plastic; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

IIC—44 to 61 inches; dark grayish brown (2.5Y 4/2) and yellowish brown (10YR 5/6) stratified gravelly loam and gravelly sandy loam; massive; friable, slightly sticky and slightly plastic; 40 percent coarse fragments; strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is generally more than 6 feet. Chroma of 2 or less is dominant throughout the profile. Depth to the IIC horizon is more than 40 inches. If these soils are not limed, reaction is strongly acid or very strongly acid. Content of coarse fragments is commonly less than 20 percent in the solum but is generally more than 20 percent in the C horizon.

The Ap horizon, if present, is dark grayish brown (10YR 4/2) to gray (10YR 5/1). The B horizon is light gray (5Y 7/1) or (N 7/0) to dark grayish brown (10YR 4/2) and is mottled. It is light silty clay loam, light clay loam, loam, or silt loam and is gravelly in places. The C horizon is similar to the B horizon in color. It is light silty clay loam to sandy loam and is gravelly.

Atkins soils are closely associated on flood plains with the deep, very poorly drained Dunning soils; the deep, moderately well drained Philo and Basher soils; and the deep, well drained Pope soils. Atkins soils are near the deep, poorly drained Purdy soils; the deep, somewhat poorly drained Tyler soils; the deep, moderately well drained Monongahela soils; and the deep, well drained Allegheny soils on the associated stream terraces. Atkins soils are similar in drainage to Melvin soils, but are more acid throughout.

At—Atkins silt loam. This nearly level soil is in flat areas on flood plains. Areas generally range from 2 to 100 acres in size. Runoff is very slow to ponded, and the erosion hazard is slight unless flooding occurs. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping, occasionally flooded, and very stony Atkins soils. Also included are a few small areas of soils that are similar to Atkins soils but are redder, of soils that have stratified sand and gravel within a depth of 40 inches, and of soils that have no mottles above a depth of 12 inches. Small areas of Dunning, Philo, and Purdy soils are also included.

Most of the acreage is idle or used for pasture. This soil is well suited to pasture if suited forage species are used. The high water table and frequent flooding delay use in spring. A bedding system or drainage field ditches help lower the water table and allow use earlier in spring.

Most limitations are caused by frequent flooding by stream overflow or localized ponding and the high water table. Capability subclass IIIw.

Basher Series

The Basher series consists of deep, moderately well drained soils formed in alluvium washed from uplands underlain by red shale, siltstone, and sandstone. These nearly level soils are on flood plains.

In a representative profile in woodland, the surface layer is very dark gray loam about 2 inches thick. The subsurface layer is dark reddish brown loam 3 inches thick. The subsoil is brown and reddish brown loam 28 inches thick. Pinkish gray, gray, yellowish red, and strong brown mottles are below a depth of 21 inches. The substratum to a depth of 60 inches is reddish brown very gravelly loam that has gray and strong brown mottles.

Permeability is moderate, and available water capacity is high. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods, and flooding is occasional. Most limitations are related to flooding and the seasonal high water table.

Most of the acreage of these soils is in cropland, but woodland and pasture are other common uses.

Representative profile of Basher loam in woodland along Bald Eagle Creek, in California Hollow, 400 feet north of Blair County line, 0.6 mile northwest of U.S. 220, 6.5 miles southwest of Port Matilda in Taylor Township:

A1—0 to 2 inches; very dark gray (10YR 3/1) loam; weak fine granular structure; very friable, nonsticky and nonplastic; 10 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—2 to 5 inches; dark reddish brown (5YR 3/4) loam; weak thin platy structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; very strongly acid; clear smooth boundary.

B1—5 to 13 inches; brown (7.5YR 4/4) loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid; clear wavy boundary.

B21—13 to 21 inches; reddish brown (5YR 4/4) loam; weak medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; strongly acid; gradual wavy boundary.

B22—21 to 26 inches; reddish brown (5YR 4/4) loam; common fine distinct pinkish gray (5YR 6/2) and yellowish red (5YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; strongly acid; clear wavy boundary.

B23—26 to 33 inches; brown (7.5YR 5/4) loam; many coarse prominent gray (10YR 6/1) mottles and common fine distinct strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid; clear wavy boundary.

C—33 to 60 inches; reddish brown (5YR 4/3) very gravelly loam; many medium prominent gray (10YR 6/1) mottles and common fine distinct strong brown (7.5YR 5/8) mottles; massive; friable, slightly sticky and nonplastic; 60 percent coarse fragments; strongly acid.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock is generally more than 6 feet, and depth to stratified sand and gravel is more than 40 inches. Content of coarse fragments ranges from 0 to 20 percent above a depth of 30 inches and from 5 to 60 percent below a depth of 30 inches. If these soils are not limed, reaction is very strongly acid to medium acid in the solum and strongly acid or medium acid in the C horizon.

The Ap horizon, if present, is dark reddish brown (5YR 3/2) to reddish brown (5YR 4/4) or dark brown (7.5YR 4/4). The B horizon dominantly is reddish brown (5YR 4/4) to strong brown (7.5YR 5/6) and is mottled below a depth of 18 to 24 inches. It is generally loam, but is silt loam and sandy loam in places and is gravelly in some areas. The C horizon is generally similar to the B horizon in color and texture. The IIC horizon, if present, ranges widely in color and texture.

Basher soils are associated on flood plains with the deep, well drained Pope soils; the deep, poorly drained Atkins soils; and the deep, very poorly drained Dunning soils. Basher soils are near the deep, moderately well drained Albrights soils and the deep well drained Leck Kill, Meckesville, and Ungers soils on uplands. Basher soils are similar in drainage to Philo soils. They are redder than Philo soils.

Ba—Basher loam. This nearly level soil is in flat areas on flood plains. Areas generally range from 3 to 40 acres in size. Runoff is slow, and the erosion hazard is slight unless flooding occurs.

Included with this soil in mapping are a few small areas of gently sloping and frequently flooded Basher soils and of soils that have mottles between depths of 12 and 18 inches. Also included are a few small areas of soils that are similar to Basher soils but that have stratified sand and gravel within a depth of 40 inches. Small areas of Philo, Atkins, and Albrights soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Alfalfa and winter grain are

affected by frost heaving. The seasonal high water table and occasional flooding delay tillage in spring. Tile drainage and drainage field ditches help lower the water table and allow tillage earlier in spring.

Most limitations are related to flooding, caused by stream overflow or localized ponding, and to the seasonal high water table. Capability subclass IIw.

Berks Series

The Berks series consists of moderately deep, well drained soils that formed in shale and siltstone residuum. These gently sloping to very steep soils are mainly in convex positions on uplands.

In a representative profile in woodland, 1 inch of organic material covers a surface layer of black shaly silt loam about 1 inch thick. The subsurface layer is yellowish brown shaly silt loam 3 inches thick. The subsoil is yellowish brown shaly and very shaly silt loam 15 inches thick. The substratum is yellowish brown very shaly silt loam 5 inches thick. Olive fractured shale and siltstone bedrock is below a depth of 24 inches.

Permeability is moderately rapid, and available water capacity is very low. Most limitations are related to the moderate depth to rippable shale, slope, droughtiness, and the many coarse fragments throughout these soils.

Most of the acreage of these soils is in woodland. Some areas are used for crops or pasture.

Representative profile of Berks shaly silt loam in an area of Berks and Weikert soils, steep, in woodland, along T-398, 0.7 mile northeast of its junction with Pa-144 at Runville in Boggs Township:

O2—1 inch to 0; black (N 2/0) partly decomposed organic material.

A1—0 to 1 inch; black (10YR 2/1) shaly silt loam; weak very fine granular structure; very friable, slightly sticky and slightly plastic; 25 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—1 inch to 4 inches; yellowish brown (10YR 5/4) shaly silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable, slightly sticky and slightly plastic; 25 percent coarse fragments; very strongly acid; clear wavy boundary.

B2—4 to 10 inches; yellowish brown (10YR 5/6) shaly silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 35 percent coarse fragments; strongly acid; clear wavy boundary.

B3—10 to 19 inches; yellowish brown (10YR 5/6) very shaly silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 60 percent coarse fragments; strongly acid; clear wavy boundary.

C—19 to 24 inches; yellowish brown (10YR 5/6) very shaly silt loam; structure obscured by stratified shale and siltstone fragments; friable, slightly sticky and nonplastic; 75 percent coarse fragments; strongly acid; clear wavy boundary.

R—24 inches; olive (5Y 4/3) fractured shale and siltstone bedrock.

The solum is 18 to 36 inches thick. Depth to rippable bedrock ranges from 20 to 40 inches. Coarse fragments of shale, siltstone, and fine-grained sandstone make up 20 to 50 percent of the A horizon, 30 to 70 percent of the B horizon, and 60 to 80 percent of the C horizon. If these soils are not limed, reaction is strongly acid or very strongly acid throughout.

In undisturbed areas, these soils have thin A1 and A2 horizons. The A1 horizon is black (10YR 2/1) to very dark grayish brown (10YR 3/2). The A2 horizon is generally brown (10YR 5/3) or yellowish brown (10YR 5/4). These horizons are shaly silt loam or loam. The B horizon is yellowish brown (10YR 5/8) or reddish yellow (7.5YR 6/6) shaly or very shaly silt loam or loam. The C horizon is similar to the B horizon in color and texture.

Berks soils are associated with the shallow, well drained Weikert soils; the deep, moderately well drained Wharton soils; and the moderately deep, poorly drained Markes soils.

BkB—Berks shaly silt loam, 3 to 8 percent slopes. This gently sloping soil is in convex areas on uplands. Areas generally range from 3 to 30 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but it is about 5 to 15 inches thicker over bedrock and in many places the surface layer has been disturbed by cultivation.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Berks soils and small areas of Wharton, Weikert, and Markes soils. Also included are areas of soils that are similar to Berks soils but that are more than 40 inches deep over shale bedrock; these areas make up as much as 25 percent of the unit.

Most of the acreage of this soil is used for pasture or is idle. Because of droughtiness and moderate depth to bedrock, production of most crops is limited. If the soil is cultivated, intensive conservation practices are necessary to control erosion and retain soil nutrients.

Most limitations are caused by droughtiness, the moderate depth to rippable bedrock, and the many coarse fragments throughout the profile. Capability subclass IIe.

BkC—Berks shaly silt loam, 8 to 15 percent slopes. This sloping soil is in convex areas on uplands. Areas generally range from 5 to 50 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but it is about 5 to 15 inches thicker over bedrock and in many places the surface layer has been disturbed by cultivation.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Berks soils and small areas of Weikert, Wharton, and Markes soils. Also included are areas of soils that are similar to Berks soils but that are more than 40 inches deep over shale bedrock; these areas make up as much as 25 percent of the unit.

Most of the acreage of this soil is used for pasture or is idle. Because of droughtiness, slope, and moderate depth to bedrock, production of most crops is limited.

If the soil is cultivated, very intensive conservation practices are necessary to control erosion and retain soil nutrients.

Most limitations are caused by droughtiness, the moderate depth to rippable bedrock, slope, and the many coarse fragments throughout the profile. Capability subclass IIIe.

BkD—Berks shaly silt loam, 15 to 25 percent slopes. This moderately steep soil is in convex areas on uplands. Areas generally range from 3 to 40 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping, steep, or severely eroded Berks soils and small areas of Weikert and Wharton soils. Also included are areas of soils that are similar to Berks soils but that are more than 40 inches deep over shale bedrock; these areas make up as much as 25 percent of the unit.

Most of the acreage is in woodland. This soil is suited to woodland. Because of slope, droughtiness, and the moderate depth to bedrock (fig. 9), production of most crops and pasture plants is limited. Because the erosion hazard is high, the soil is better suited to hay and pasture than to cultivated crops.

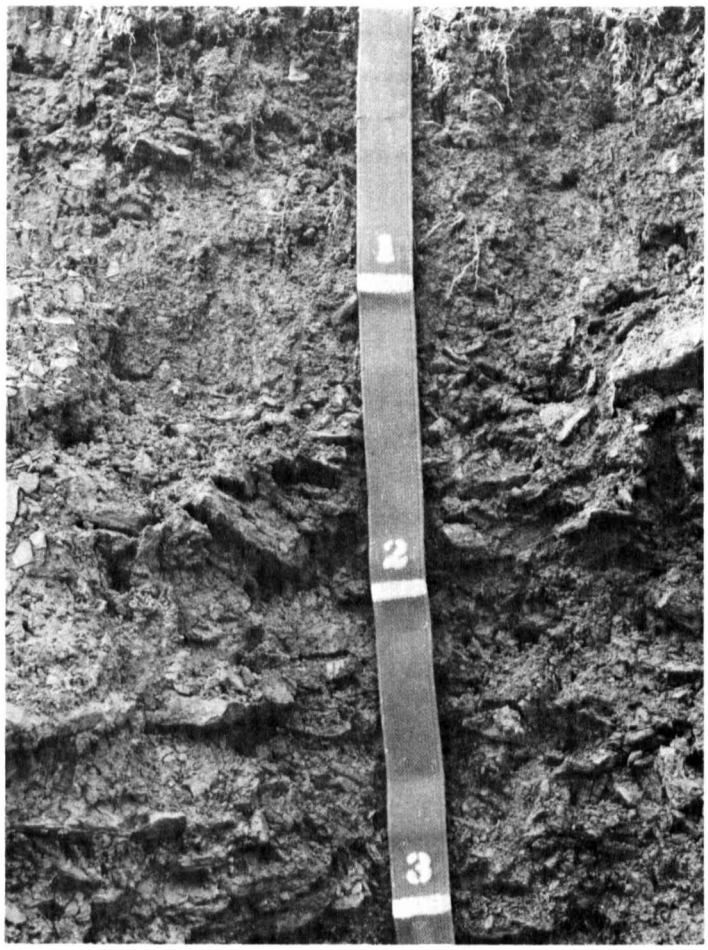

Figure 9.—**Profile of Berks shaly silt loam, 15 to 25 percent slopes. Thin-bedded shale bedrock is at a depth of about 27 inches.**

Most limitations are caused by slope, the moderate depth to rippable bedrock, droughtiness, the high erosion hazard, and the many coarse fragments throughout the profile. Capability subclass IVe.

BlD—Berks very stony silt loam, 8 to 25 percent slopes. This sloping and moderately steep soil is in convex areas on uplands. Areas generally range from 3 to 30 acres in size. Runoff is medium to rapid. From 3 to 8 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but it is about 5 to 15 inches thicker over bedrock.

Included with this soil in mapping are a few small areas of nearly level, gently sloping, or nonstony Berks soils and small areas of Weikert, Wharton, and Markes soils. Also included are areas of soils that are similar to Berks soils but that are more than 40 inches deep over shale bedrock; these areas make up as much as 25 percent of the unit.

Most of the acreage is in woodland. This soil is suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many surface stones make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness, slope, droughtiness, and the moderate depth to rippable bedrock. Capability subclass VIs.

BMF—Berks and Weikert soils, steep. These soils are mainly in convex areas on uplands. Slopes are 25 to 60 percent. This mapping unit is about 50 percent Berks soil and about 25 percent Weikert soil. Some areas, however, are all Berks soil, all Weikert soil, or any combination of the two. Areas generally range from 5 to 200 acres in size. Runoff is rapid to very rapid. As much as 10 percent of the surface is covered by stones 10 to 24 inches in diameter. The surface layer is shaly silt loam or loam. The Berks and Weikert soils have the profiles described as representative of their respective series.

Included with these soils in mapping are areas of soils that are similar to Berks soils but that are more than 40 inches deep over bedrock. Because these soils are steep, areas of this mapping unit were not investigated so thoroughly as areas of less sloping Berks and Weikert soils; therefore, areas of this mapping unit contain more inclusions than areas of less sloping Berks and Weikert soils.

Most areas are in woodland. These soils are fairly well suited to woodland. Because of steep slopes and droughtiness, the soils are better suited to wildlife habitat and esthetic uses than to most other uses.

Most limitations are caused by the steep and very steep slopes, droughtiness, and the shallow and moderate depth to rippable bedrock. Capability subclass VIIe.

Brinkerton Series

The Brinkerton series consists of deep, poorly drained soils that formed in siltstone, shale, and sandstone colluvium. These nearly level to sloping soils are on concave midslopes and lower foot slopes and areas along small drainageways of the predominantly shale uplands.

In a representative profile the surface layer is dark grayish brown silt loam about 9 inches thick. The upper

12 inches of the subsoil is light brownish gray and gray silt loam and silty clay loam that has strong brown and dark brown mottles. The lower 17 inches is a fragipan of firm and brittle, gray, grayish brown, and brown shaly silt loam that has grayish brown, strong brown, light olive brown, dark brown, and dark yellowish brown mottles. The substratum to a depth of 62 inches is grayish brown and brown shaly silt loam that has strong brown mottles.

Permeability is slow, and available water capacity is moderate. A high water table is above a depth of one-half foot during wet periods, and occasional ponding occurs in flat areas. A fragipan is in the lower part of the subsoil. Most limitations are related to the high water table, slow permeability, and surface stones in some very stony areas.

About half the acreage of these soils is in woodland, and the rest is in pasture or is idle.

Representative profile of Brinkerton silt loam, 3 to 8 percent slopes, along a field road 550 feet north of the Bald Eagle Area High School at Wingate in Boggs Township:

Ap—0 to 9 inches; dark grayish brown (2.5Y 4/2) silt loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; neutral; abrupt smooth boundary.

B21tg—9 to 14 inches; light brownish gray (2.5Y 6/2) silt loam; many medium prominent strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; few faint clay films on ped faces and in pores; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B22tg—14 to 21 inches; gray (10YR 6/1) silty clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles and few coarse prominent dark brown (10YR 4/3) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; friable to firm, slightly sticky and plastic; common faint clay and silt films on ped faces; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1g—21 to 27 inches; gray (5Y 6/1) prism faces, grayish brown (10YR 5/2) ped interiors of shaly silt loam; many coarse distinct strong brown (7.5YR 5/6) mottles and common medium faint dark yellowish brown (10YR 4/4) mottles; weak very coarse prismatic structure parting to weak thick platy and moderate medium subangular blocky; firm, brittle, slightly sticky and plastic; 15 percent coarse fragments; common faint clay films and silt coats on ped faces; very strongly acid; clear wavy boundary.

Bx2g—27 to 38 inches; gray (5Y 6/1) prism faces, brown (10YR 5/3) ped interiors of shaly silt loam; many coarse faint dark yellowish brown (10YR 4/4) mottles and few fine faint light olive brown (2.5Y 5/4) mottles; weak very coarse prismatic structure parting to weak thick platy and moderate fine subangular blocky; firm, brittle, slightly sticky and plastic; 20 percent coarse fragments; common faint clay films and silt coats on ped faces and in pores; many moderate black coatings on ped faces; medium acid; gradual wavy boundary.

Bx3g—38 to 44 inches; gray (5Y 6/1) prism faces, brown (10YR 5/3) ped interiors of shaly silt loam; few fine distinct grayish brown (2.5Y 5/2) and dark brown (7.5YR 4/4) mottles; weak very coarse prismatic structure parting to weak thick platy and moderate fine subangular blocky; firm, brittle, slightly sticky and slightly plastic; 20 percent coarse fragments; common faint clay films and silt coats on ped faces and many moderate clay films in pores; medium acid; gradual wavy boundary.

Cg—44 to 62 inches; grayish brown (10YR 5/2) prism faces, brown (10YR 5/3) interiors of shaly silt loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure; firm, slightly sticky and slightly plastic; 40 percent coarse fragments; common faint clay films on coarse fragments and in pores; slightly acid.

The solum is 40 to 50 inches thick. Depth to bedrock is more than 5 feet. Depth to the fragipan ranges from 15 to 30 inches. Content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum, 5 to 30 percent in the fragipan, and 10 to 50 percent in the C horizon. If these soils are not limed, reaction is very strongly acid to medium acid in the solum and strongly acid to slightly acid in the C horizon.

The Ap horizon, where present, is dark grayish brown (2.5Y 4/2) to grayish brown (10YR 5/2) or brown (10YR 5/3). The Bt horizon is light brownish gray (2.5Y 6/2) to grayish brown (10YR 5/2) or gray (10YR 5/1) and is generally mottled. It is heavy silt loam or silty clay loam. The Bx horizon has gray (N 5/0) or light brownish gray (10YR 6/2) prism faces and mottled ped interiors. It is silt loam, light silty clay loam, or loam and is shaly or channery. The C horizon is similar to the Bx horizon in color. It is silt loam or loam and is shaly or channery.

Brinkerton soils occupy the same colluvial landscape as the deep, moderately well drained Ernest soils. They are near the moderately deep, well drained Berks and Gilpin soils and the deep, moderately well drained Wharton soils. Brinkerton soils are similar to Andover and Purdy soils in drainage. They have less sand in the B horizon and fewer coarse fragments throughout the profile than Andover soils. They have less clay in the B horizon than Purdy soils.

BrA—Brinkerton silt loam, 0 to 3 percent slopes. This nearly level soil is in concave or flat areas on uplands. Areas generally range from 2 to 20 acres in size. Runoff is slow, and occasional ponding occurs during wet periods. The erosion hazard is slight in cultivated areas.

Included with this soil in mapping are a few small

areas of gently sloping and very stony Brinkerton soils and of soils that are more than 10 percent coarse fragments in the surface layer. Also included are a few small areas of soils that are similar to Brinkerton soils but that are redder, of soils that have no mottles above a depth of 12 inches, and of wetter soils that have a black surface layer. Small areas of Purdy, Ernest, and Wharton soils are also included.

Most of the acreage is used for pasture or is idle. This soil is suited to woodland or summer pasture. The high water table delays tillage or the use of pasture in spring. A bedding system helps to lower the water table and allows more intensive use for crops or pasture.

Most limitations are caused by the high water table, localized ponding during wet periods, and slow permeability. Capability subclass IVw.

BrB—Brinkerton silt loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on uplands. Areas generally range from 3 to 30 acres in size. Runoff is slow to medium, and occasional ponding occurs in depressional areas. The erosion hazard is slight to moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Brinkerton soils and of soils that are more than 10 percent coarse fragments in the surface layer. Also included are a few small areas of soils that are similar to Brinkerton soils but that are redder, of soils that have no mottles above a depth of 12 inches, and of wetter soils that have a black surface layer. Small areas of Purdy, Ernest, and Wharton soils are also included.

Most of the acreage is used for pasture or is idle. This soil is suited to woodland or summer pasture. The high water table delays tillage and the use for pasture in spring. In cultivated areas, stripcropping, and using diversion terraces, waterways, and tile drains help to control erosion, retain soil nutrients, and lower the water table so the soil can be used more intensively.

Most limitations are caused by the high water table and slow permeability. Capability subclass IVw.

BrC—Brinkerton silt loam, 8 to 15 percent slopes. This sloping soil is in concave areas on uplands. Areas generally range from 3 to 20 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping and very stony Brinkerton soils. Also included are a few small areas of soils that are similar to Brinkerton soils but have no mottles above a depth of 12 inches, of soils that are more than 10 percent coarse fragments in the surface layer, and of soils that are similar to Brinkerton soils but that are redder. Small areas of Ernest, Wharton, and Berks soils are also included.

About half the acreage is in woodland, and the rest is idle or used for pasture. This soil is suited to woodland. The high water table delays the use for pasture in spring. Diversion terraces, waterways, and tile drains help to control erosion, retain soil nutrients, and lower the water table to allow use earlier in spring.

Most limitations are caused by the high water table, slope, and slow permeability. Capability subclass IVw.

BsB—Brinkerton very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in concave areas on uplands. Areas generally range from 3 to 20 acres in size. Runoff is slow to medium, and occasional ponding occurs during wet periods. From 3 to 10 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of sloping and nonstony Brinkerton soils. Also included are a few small areas of soils that are similar to Brinkerton soils but that are redder, of soils that have no mottles above a depth of 12 inches, and of wetter soils that have a black surface layer. Small areas of Purdy, Ernest, and Wharton soils are also included.

Most of the acreage is used for woodland. This soil is suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness, the high water table, localized ponding during wet periods, and slow permeability. Capability subclass VIIs.

Buchanan Series

The Buchanan series consists of deep, moderately well drained soils that formed in sandstone, siltstone, and shale colluvium. These nearly level to moderately steep soils are on concave midslopes and lower foot slopes along the base of mountains and in depressions at the heads of drainageways in mountains.

In a representative profile in woodland, 2 inches of organic material covers a surface layer of dark gray channery loam about 2 inches thick. The subsurface layer is yellowish brown channery loam 4 inches thick. The subsoil is yellowish brown channery loam and is mottled with grayish brown, gray, and yellowish red mottles below a depth of 21 inches. The upper 21 inches of the subsoil is friable and firm, and the lower 20 inches is a firm and brittle fragipan. The substratum is yellowish brown channery loam mottled with yellowish red to a depth of 60 inches.

Permeability is slow, and available water capacity is moderate. A fragipan is in the lower part of the subsoil. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods. Most limitations are related to the seasonal high water table, slow permeability, slope, and surface stones in some extremely stony areas.

Most of the acreage of these soils is in woodland. Some areas are in pasture or are idle.

Representative profile of a Buchanan channery loam in an area of Buchanan extremely stony loam, 8 to 25 percent slopes, in woodland, 180 feet west of Woodward Gap Road, 0.25 mile south of Woodward in Haines Township:

O1—2 inches to 1 inch; undecomposed oak, maple, and huckleberry leaf mat.

O2—1 inch to 0; fibrous organic mat held together by roots and mycelia; abrupt smooth boundary.

A1—0 to 2 inches; dark gray (10YR 4/1) channery loam; weak fine granular structure; very friable, nonsticky and nonplastic; 15 percent coarse fragments; extremely acid; clear smooth boundary.

A2—2 to 6 inches; yellowish brown (10YR 5/4)

channery loam; weak fine granular structure; friable, nonsticky and nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.

B1—6 to 15 inches; yellowish brown (10YR 5/4) channery loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—15 to 21 inches; yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable, sticky and slightly plastic; 20 percent coarse fragments; few faint clay films on ped faces; very strongly acid; clear wavy boundary.

B22t—21 to 27 inches; yellowish brown (10YR 5/6) channery loam; few coarse distinct yellowish red (5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm, slightly sticky and plastic; 20 percent coarse fragments; many moderate clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

Bx1—27 to 32 inches; yellowish brown (10YR 5/4) channery loam; common coarse distinct yellowish red (5YR 5/6) and gray (10YR 6/1) mottles; moderate very coarse prismatic structure parting to weak thick platy and weak medium subangular blocky; firm, brittle, slightly sticky and slightly plastic; 25 percent coarse fragments; few faint clay films on ped faces; strongly acid; clear wavy boundary.

Bx2—32 to 47 inches; yellowish brown (10YR 5/6) channery loam; common coarse distinct gray (10YR 6/1) and yellowish red (5YR 5/6) mottles; weak very coarse prismatic structure parting to weak thick platy and weak coarse angular blocky; firm, brittle, slightly sticky and slightly plastic; 30 percent coarse fragments; few faint clay films on ped faces; common black oxide coatings; strongly acid; gradual wavy boundary.

C—47 to 60 inches; yellowish brown (10YR 5/6) channery loam; few coarse distinct yellowish red (5YR 5/6) mottles; weak coarse angular blocky structure; firm, slightly sticky and slightly plastic; 40 percent coarse fragments; strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Depth to the fragipan ranges from 20 to 36 inches. Content of coarse fragments ranges from 5 to 35 percent above the fragipan and from 10 to 60 percent in the fragipan and C horizon. If these soils are not limed, reaction ranges from extremely acid to strongly acid throughout.

In undisturbed areas, these soils have thin A1 and A2 horizons covered by a thin organic layer. The A1 horizon generally is dark gray (10YR 4/1) or very dark gray (10YR 3/1), and the A2 horizon generally is yellowish brown (10YR 5/4) or brown (10YR 5/3). The A horizon is loam or channery loam. The B horizon is generally yellowish brown (10YR 5/4 or 5/6), and it is mottled gray (10YR 6/1) to yellowish red (5YR 5/6) in the lower part. The B horizon is silt loam to sandy clay loam and is generally channery or gravelly. The C horizon is generally similar to the B horizon in color and texture.

Buchanan soils occupy the same colluvial landscape in the Valley and Ridge province as the deep, well drained Laidig soils and the deep, poorly drained Andover soils. On the Allegheny Plateau, they are associated with the deep, well drained Clymer and Hazleton soils and the deep, poorly drained Andover soils. Buchanan soils are similar to Albrights and Ernest soils in drainage. They contain more sand than these soils. They are not so red as Albrights soils.

BtB—Buchanan loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is in concave areas on uplands on the Allegheny Plateau. Areas range from 5 to 75 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but there are about 10 percent fewer coarse fragments in the surface layer and subsurface layer.

Included with this soil in mapping are a few small areas of sloping Buchanan channery loam and of very stony Buchanan soils. Also included are a few small areas of soils that are similar to Buchanan soils but that are mottled between depths of 12 and 18 inches. Small areas of Andover, Clymer, and Hazleton soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. Although the soil is very well suited to crops, its inaccessibility in the northwestern part of the county limits farm use other than woodland. If it is used for crops, alfalfa and winter grain are affected by frost heaving.

Most limitations are caused by the seasonal high water table and the slow permeability. Capability subclass IIe.

BuB—Buchanan channery loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on uplands of the Valley and Ridge province. Areas generally range from 5 to 75 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Buchanan soils and of soils that are similar to Buchanan soils but that are mottled between depths of 12 and 18 inches. Small areas of Andover and Laidig soils are also included.

Most of the acreage is used for crops or pasture. This soil is well suited to crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Stripcropping and using waterways and diversion terraces help to control erosion, retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table, the slow permeability, and the many coarse

fragments throughout the profile. Capability subclass IIe.

BuC—Buchanan channery loam, 8 to 15 percent slopes. This sloping soil is in concave areas on colluvial uplands of the Valley and Ridge province. Areas generally range from 4 to 50 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Buchanan soils and of soils that are similar to Buchanan soils but that are mottled between depths of 12 and 18 inches. Small areas of Laidig and Andover soils are also included.

Most of the acreage is used for pasture or crops. This soil is well suited to pasture or crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays use in spring. Stripcropping and using diversion terraces and waterways are necessary to control erosion, retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by slope, the seasonal high water table, and the slow permeability. Capability subclass IIIe.

BxB—Buchanan extremely stony loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in concave areas on uplands. Areas generally range from 4 to 75 acres in size. Runoff is slow to medium. From 15 to 25 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of sloping and very stony Buchanan soils and of soils that are similar to Buchanan soils but that are mottled between depths of 12 and 18 inches. Small areas of Andover and Laidig soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness, the seasonal high water table, and the slow permeability. Capability subclass VIIs.

BxD—Buchanan extremely stony loam, 8 to 25 percent slopes. This sloping to moderately steep soil is in concave areas on uplands. Areas generally range from 4 to 60 acres in size. Runoff is medium to rapid. From 15 to 25 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping and very stony Buchanan soils and of soils that are similar to Buchanan soils but that have more than 35 percent coarse fragments throughout. Small areas of Laidig and Hazleton soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness, slope, the seasonal high water table, and the slow permeability. Capability subclass VIIs.

Calvin Series

The Calvin series consists of moderately deep, well drained soils that formed in shale, siltstone, and sandstone residuum. These steep to very steep soils are in convex positions on uplands.

In a representative profile in woodland, the surface layer is black channery loam about 2 inches thick. The subsurface layer is reddish brown channery loam 5 inches thick. The subsoil is dark reddish brown and dusky red channery loam 28 inches thick. The substratum is dusky red very channery loam 4 inches thick. Dusky red siltstone bedrock is at a depth of 39 inches.

Permeability is moderately rapid, and available water capacity is low to moderate. Most limitations are related to slope, the moderate depth to rippable shale or siltstone bedrock, and the many coarse fragments throughout the profile.

Most of the acreage of these soils is in woodland.

In Centre County, Calvin soils are mapped only in an undifferentiated group with Leck Kill soils.

Representative profile of Calvin channery loam in an area of Leck Kill and Calvin soils, steep, in woodland, along T–345, 800 feet northeast of its junction with L.R. 14007, 3 miles west of Julian in Huston Township:

A1—0 to 2 inches; black (5YR 2/1) channery loam; weak fine granular structure; very friable, nonsticky and nonplastic; 25 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—2 to 7 inches; reddish brown (5YR 4/3) channery loam; weak fine granular structure; very friable, nonsticky and nonplastic; 20 percent coarse fragments; very strongly acid; clear smooth boundary.

B2—7 to 28 inches; dark reddish brown (2.5YR 3/4) channery loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; 35 percent coarse fragments; very strongly acid; gradual smooth boundary.

B3—28 to 35 inches; dusky red (10YR 3/4) channery loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 40 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—35 to 39 inches; dusky red (10YR 3/4) very channery loam; massive; friable, nonsticky and nonplastic; 70 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—39 inches; dusky red (10R 3/3) siltstone bedrock.

The solum ranges from 20 to 35 inches in thickness. Depth to rippable bedrock ranges from 20 to 40 inches. Coarse fragments of shale, siltstone, and sandstone make up 5 to 25 percent of the A horizon, 25 to 55 percent of the B horizon, and 40 to 80 percent of the C horizon. If these soils are not limed, reaction commonly is very strongly acid or strongly acid.

In undisturbed areas, these soils have a thin black (5YR 2/1) A1 horizon underlain by a reddish brown

(5YR 4/3) A2 horizon. The A horizon is channery or shaly loam or silt loam. The B horizon is dark reddish brown (5YR 3/3) to weak red (10R 5/3) or red (10R 5/6). It is silt loam, loam, or light clay loam and is shaly or channery. The C horizon is generally weak red (10R 4/2) or dusky red (10R 3/4). It is commonly very shaly or very channery silt loam or loam.

Calvin soils are associated with the deep, well drained Leck Kill and Meckesville soils and the deep, moderately well drained Albrights soils. Calvin soils are similar to Berks soils in drainage and depth to bedrock. They are redder than Berks soils.

Carlisle Series

The Carlisle series consists of deep, very poorly drained organic soils that formed in woody organic deposits more than 51 inches thick. These nearly level soils are in bogs in old lakebeds or swampy areas.

In a representative profile in a wooded bog, the upper 19 inches is black highly decomposed muck. Between depths of 19 and 67 inches is very dusky red and black highly decomposed muck and between depths of 67 and 85 inches is dark reddish brown highly decomposed muck. Between depths of 85 and 108 inches is dark brown slightly decomposed peat and between depths of 108 and 111 inches is dark grayish brown highly decomposed muck. The substratum is gray silt loam to a depth of 118 inches.

Permeability is moderately rapid, and available water capacity is high. A high water table is at the surface during most of the year and flooding is very frequent. Most limitations are related to very frequent flooding, the high water table, and the organic nature of the soils.

Most of the acreage of these soils is in woodland or is grass-covered swampy areas.

Representative profile of Carlisle muck in a wooded bog in Bear Meadows Natural Area, 600 feet south of woodland trail, 0.5 mile southwest of its junction with North Meadows Road, 1,500 feet west of its junction with Wampler Road, 4.5 miles south of Boalsburg in Harris Township:

Oi1—0 to 2 inches; very dusky red (2.5YR 2/2) broken, pressed, and rubbed; about 85 percent fibers, 60 percent rubbed; weak fine granular structure; very friable; fibers are dominantly woody; very strongly acid; abrupt smooth boundary.

Oa1—2 to 8 inches; black (10YR 2/1) broken and rubbed, very dark brown (10YR 2/2) pressed; about 40 percent fibers, 15 percent rubbed; weak fine granular structure; very friable; about 60 percent woody and 40 percent herbaceous fibers; very strongly acid; clear smooth boundary.

Oa2—8 to 19 inches; black (10YR 2/1) broken, pressed, and rubbed; about 25 percent fibers, 5 percent rubbed; massive; very friable; about 60 percent woody and 40 percent herbaceous fibers; very strongly acid; clear smooth boundary.

Oa3—19 to 29 inches; very dusky red (2.5YR 2/2) broken, pressed, and rubbed; about 30 percent fibers, 8 percent rubbed; massive; very friable; fibers are dominantly woody; very strongly acid; clear smooth boundary.

Oa4—29 to 40 inches; black (N 2/0) broken and pressed, very dusky red (2.5YR 2/2) rubbed; about 25 percent fibers, less than 5 percent rubbed; massive; very friable; fibers are dominantly woody; very strongly acid; clear smooth boundary.

Oa5—40 to 67 inches; black (N 2/0) broken and rubbed, black (5YR 2/1) pressed; about 20 percent fibers, 5 percent rubbed; massive; very friable; fibers are dominantly woody; very strongly acid; clear smooth boundary.

Oa6—67 to 85 inches; dark reddish brown (5YR 3/3) broken, dark reddish brown (5YR 2/2) pressed, black (5YR 2/1) rubbed; about 10 percent fibers, less than 5 percent rubbed; massive; very friable; about 60 percent woody and 40 percent herbaceous fibers; very strongly acid; abrupt smooth boundary.

Oi2—85 to 108 inches; dark brown (7.5YR 3/2) broken, pressed, and rubbed; about 90 percent fibers, 80 percent rubbed; massive; very friable; about half sphagnum and half herbaceous fibers; very strongly acid; abrupt smooth boundary.

Oa7—108 to 111 inches; dark grayish brown (10YR 4/2) broken, pressed, and rubbed; about 20 percent fibers, 5 percent rubbed; massive; friable, nonsticky and slightly plastic; about half sphagnum and half herbaceous fibers; about 20 percent mineral content; very strongly acid; abrupt smooth boundary.

IICg—111 to 118 inches; gray (10YR 5/1) silt loam; massive; firm, slightly sticky and slightly plastic; medium acid.

The organic deposit is more than 51 inches thick. depth to bedrock is more than 6 feet. Content of woody fragments is as much as 25 percent, throughout, in some profiles. Reaction is very strongly acid or strongly acid in the organic material.

The surface tier is typically black (5YR 2/1) and is predominantly sapric material. The subsurface tier is dominantly black (5YR 2/1) or dark reddish brown (5YR 2/2) and is dominated by sapric material with a rubbed fiber content of less than 10 percent of the organic volume. The bottom tier is similar to the subsurface tier in color and has variable amounts of woody and herbaceous material.

Carlisle soils are closely associated in depressions with the deep, poorly drained Andover soils; the deep, moderately well drained Buchanan soils; and the deep, well drained Hazleton and Clymer soils on uplands. They are near the deep, very poorly drained Dunning soils; the deep, poorly drained Atkins soils; the deep, moderately well drained Philo soils; and the deep, well drained Pope soils on flood plains.

CA—Carlisle muck. This nearly level organic soil is in flat bogs in old lake beds or swampy areas (fig. 10).

Figure 10.—An area of Carlisle muck near Black Moshannon State Park.

Areas generally range from 40 to 200 acres in size. Runoff is very slow, and frequent ponding occurs.

Included with this soil in mapping are areas of organic soils that formed dominantly in herbaceous material and of organic soils that are less than 51 inches thick over mineral soil. Small areas of Dunning, Atkins, and Andover soils are also included. Because this soil is very poorly drained, areas of this mapping unit were not investigated so thoroughly as nearby areas of mineral soils; therefore areas of this mapping unit contain many inclusions.

Most of the acreage is used for woodland or wildlife habitat. Because it is very wet, the soil is better suited to wildlife habitat and esthetic uses than to most other uses.

Most limitations are caused by very frequent flooding, the high water table, and the organic nature of the soil. Capability subclass VIIw.

Cavode Series

The Cavode series consists of deep, somewhat poorly drained soils formed in clay shale and siltstone residuum. These nearly level and gently sloping soils are in concave positions on uplands.

In a representative profile in woodland, the surface layer is very dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam that has gray mottles and is about 5 inches thick. The subsoil is 29 inches thick. It is yellowish brown and grayish brown silty clay loam that has light brownish gray and strong brown mottles. The substratum is gray shaly silty clay loam that has yellowish brown mottles and is about 26 inches thick. Gray clay shale bedrock is at a depth of 52 inches.

Permeability is slow, and available water capacity is moderate to high. A seasonal high water table is at a depth of ½ foot to 1½ feet during wet periods, and occasional ponding occurs in some areas. Most limitations are related to the seasonal high water table and slow permeability.

Most of the acreage of these soils is in woodland.

Representative profile of Cavode silt loam, 3 to 8 percent slopes, in woodland, 700 feet northwest of T-325, 0.25 mile north of Gorton, 3 miles southwest of Moshannon in Snow Shoe Township:

A1—0 to 2 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; very strongly acid; abrupt smooth boundary.

A2—2 to 7 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct gray (10YR 6/1) mottles; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; very strongly acid; clear smooth boundary.

B21t—7 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; few faint clay films on ped faces and in pores; very strongly acid; clear smooth boundary.

B22tg—18 to 36 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; 10 percent coarse fragments; common faint to moderate clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

Cg—36 to 52 inches; gray (5Y 6/1) shaly silty clay loam; many medium prominent yellowish brown (10YR 5/4) mottles; weak medium platy structure; firm, slightly sticky and plastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.

R—52 inches; gray (5Y 5/1) clay shale bedrock.

The solum ranges from 30 to 60 inches in thickness. Depth to bedrock ranges from 40 to 72 inches. Content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum, from 0 to 15 percent in the lower part of the solum, and from 10 to 50 percent in the C horizon. If these soils are not limed, reaction is very strongly acid or strongly acid throughout.

In undisturbed areas, these soils have thin A1 and A2 horizons. The A1 horizon is generally black (10YR 2/1) or very dark brown (10YR 2/2), and the A2 horizon is generally brown (10YR 5/3) or yellowish brown (10YR 5/4). The B horizon is mottled. The upper part of the B horizon is olive brown (2.5Y 4/4) to yellowish brown (10YR 5/6), and the lower part is gray (10YR 5/1) to light olive gray (5Y 6/2). The B horizon is generally silty clay loam or silty clay. The C horizon is gray (5Y 6/1) to dark yellowish brown (10YR 4/4) and is mottled. It is generally shaly silty clay loam.

Cavode soils are associated with the moderately deep,

well drained Gilpin soils; the deep, well drained Rayne soils; the deep, moderately well drained Wharton and Ernest soils; and the deep, poorly drained Armagh and Brinkerton soils.

CdA—Cavode silt loam, 0 to 3 percent slopes. This nearly level soil is in flat to concave areas on uplands. Areas generally range from 2 to 20 acres in size. Runoff is slow, and occasional ponding occurs during wet periods. The erosion hazard is slight in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping and very stony Cavode soils and of soils that are similar to Cavode soils but that have less clay in the subsoil. Small areas of Armagh, Wharton, and Brinkerton soils are also included.

Most of the acreage is in woodland. The soil is very well suited to woodland. Because areas of the soil are inaccessible, the soil has a seasonal high water table, and permeability is slow, very little of the acreage is cultivated.

Most limitations are caused by the seasonal high water table and slow permeability. Capability subclass IIIw.

CdB—Cavode silt loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on uplands. Areas generally range from 3 to 30 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Cavode soils and of soils that are similar to Cavode soils but that have less clay in the subsoil. Small areas of Armagh, Wharton, and Brinkerton soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. Because this soil is inaccessible in the mountainous areas and because it has a seasonal high water table and slow permeability, very little of the acreage is cultivated.

Most limitations are caused by the seasonal high water table and slow permeability. Capability subclass IIIw.

Chagrin Series

The Chagrin series consists of deep, well drained soils that formed in alluvial material washed from uplands underlain by limestone, sandstone, and shale. These nearly level soils are on flood plains.

In a representative profile the surface layer is dark grayish brown silt loam about 14 inches thick. The subsoil is brown silt loam and loam 27 inches thick. The substratum is dark brown silt loam that has a few dark gray and brown mottles to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. This soil is occasionally flooded and a seasonal high water table is at a depth of 3 feet at times during wet periods. Most limitations are related to occasional flooding.

Most of the acreage of these soils is used for crops or pasture.

Representative profile of Chagrin silt loam in an area of Chagrin soils, in a pasture, 725 feet west of L.R. 14031 at the point where it crosses Penns Creek, 4 miles southwest of Millheim in Penn Township:

Ap—0 to 14 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B21—14 to 20 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; clear smooth boundary.

B22—20 to 23 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; clear wavy boundary.

B23—23 to 41 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; clear wavy boundary.

C—41 to 60 inches; dark brown (10YR 4/3) silt loam; few fine faint brown (7.5YR 4/4) and dark gray (10YR 4/1) mottles; massive; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral.

The solum is 30 to 48 inches thick. Depth to bedrock is more than 6 feet. Content of coarse fragments ranges to as much as 15 percent throughout. Reaction ranges from neutral to medium acid throughout.

The Ap horizon is generally dark grayish brown (10YR 4/2) or brown (10YR 4/3). It is generally silt loam or loam, but it is sandy loam in places. The B horizon is dark brown (10YR 4/3) to yellowish brown (10YR 5/4) or brown (7.5YR 5/4). It is dominantly silt loam or loam. The C horizon varies widely in color and texture, and it is stratified in the lower part in places. In some places the C horizon is mottled.

Chagrin soils are closely associated on flood plains with the deep, moderately well drained Lindside soils; the deep, poorly drained Melvin soils; and the deep, very poorly drained Dunning soils. They are near the deep, moderately well drained Clarksburg soils; the deep, well drained Edom, Millheim, Hublersburg, and Hagerstown soils; and the shallow, well drained Opequon soils on uplands.

Ch—Chagrin soils. These nearly level soils are in flat areas on flood plains. Areas generally range from 2 to 30 acres in size. Runoff is slow, and the erosion hazard is slight unless flooding occurs. The surface layer is dominantly silt loam or loam.

Included with these soils in mapping are a few small areas of gently sloping and frequently flooded Chagrin soils. Also included are a few small areas of soils that are similar to Chagrin soils but that are more silty throughout, have a thick, dark colored surface layer, or have stratified sand and gravel within a depth of 40 inches. Small areas of Lindside and Melvin soils are also included.

Most of the acreage is used for crops or pasture. These soils are excellently suited to crops and pasture. Using cover crops and managing crop residue help to protect the soils from erosion during flooding. Areas that have been scoured should be kept in permanent hay or pasture.

Most limitations are caused by occasional flooding. Capability subclass I.

Clarksburg Series

The Clarksburg series consists of deep, moderately well drained soils that formed in limestone and calcareous shale colluvium. These nearly level and gently sloping soils are on concave lower slopes in the dominantly limestone valley.

In a representative profile the surface layer is dark brown silt loam about 14 inches thick. The upper 21 inches of the subsoil is yellowish brown and dark yellowish brown silt loam and silty clay loam. It has grayish brown and strong brown mottles below a depth of 25 inches. The lower 13 inches of the subsoil is a fragipan of firm and brittle, brown silty clay loam that has light brownish gray and yellowish brown mottles. The substratum to a depth of 63 inches is dark brown channery silty clay loam that has grayish brown and yellowish brown mottles.

Permeability is slow, and available water capacity is moderate. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods. A fragipan is in the lower part of the subsoil. Most limitations are related to the seasonal high water table and slow permeability.

Most of the acreage of these soils is in cropland.

Representative profile of Clarksburg silt loam, 3 to 8 percent slopes, in a hay field 110 feet southeast of T–411, 0.2 mile northeast of its junction with T–418, 1.75 miles northwest of Potters Mills in Potter Township:

Ap—0 to 14 inches; dark brown (10YR 4/3) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; slightly acid; clear smooth boundary.

B21t—14 to 25 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; common faint clay films on ped faces and lining pores; medium acid; clear wavy boundary.

B22t—25 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine faint grayish brown (10YR 5/2) mottles and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable, sticky and plastic; 5 percent coarse fragments; many moderate clay films on ped faces and lining pores; slightly acid; clear wavy boundary.

Bx—35 to 48 inches; brown (10YR 4/3) silty clay loam; common fine faint light brownish gray (2.5Y 6/2) mottles and common fine distinct yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; firm and brittle, sticky and plastic; 10 percent coarse fragments; common faint clay films on ped faces and lining pores; slightly acid; clear wavy boundary.

C—48 to 63 inches; dark brown (10YR 3/3) channery silty clay loam; common fine faint grayish brown (2.5Y 5/2) mottles and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm, sticky and plastic; 25 percent coarse fragments; few faint clay films lining pores; slightly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Depth to the fragipan is 24 to 36 inches. Content of coarse fragments ranges from 0 to 20 percent above the fragipan, 5 to 25 percent in the fragipan, and 10 to 75 percent in the C horizon. If these soils are not limed, reaction ranges from strongly acid to slightly acid throughout.

The Ap horizon is brown (10YR 4/3) to grayish brown (10YR 5/2). The Bt horizon is strong brown (7.5YR 5/6) to dark yellowish brown (10YR 4/4), and the lower part is mottled in places. The Bt horizon is generally silt loam or silty clay loam. The Bx horizon is reddish brown (5YR 4/3) to yellowish brown (10YR 5/6) and is mottled. It is similar to the Bt horizon in texture. The C horizon is similar to the B horizon in color and texture, but it is slightly darker in places.

Clarksburg soils are associated with the deep, well drained Edom, Millheim, Hagerstown, and Hublersburg soils and the shallow, well drained Opequon soils. They are near the deep, well drained Nolin, local alluvium, soils.

CkA—Clarksburg silt loam, 0 to 3 percent slopes. This nearly level soil is on concave lower foot slopes on uplands. Areas generally range from 2 to 20 acres in size. Runoff is slow, and the erosion hazard is slight in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping Clarksburg soils and of soils that are similar to Clarksburg soils but that have mottles between depths of 12 and 18 inches or that have more clay in the subsoil. Small areas of Edom, Hagerstown, Hublersburg, and Nolin soils are also included.

Most of the acreage is used for crops. This soil is very well suited to crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Diversion terraces or open ditches help lower the seasonal high water table and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and slow permeability. Capability subclass IIw.

CkB—Clarksburg silt loam, 3 to 8 percent slopes. This gently sloping soil is on concave upper foot slopes on uplands. Areas range from 3 to 30 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level or sloping Clarksburg soils and of soils that are similar to Clarksburg soils but that have mottles between depths of 12 and 18 inches or that have more clay in the subsoil. Small areas of Edom, Hagerstown, Hublersburg, and Nolin soils are also included.

Most of the acreage is used for crops. This soil is very well suited to crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Stripcropping and using diversion terraces and waterways help to control erosion, retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and slow permeability. Capability subclass IIe.

Clymer Series

The Clymer series consists of deep, well drained soils that formed in sandstone and siltstone residuum. These nearly level to moderately steep soils are in high positions on mountains.

In a representative profile in woodland, about 2 inches of organic material covers a surface layer of very dark brown sandy loam about 1 inch thick. The subsurface layer is yellowish brown sandy loam 2 inches thick. The subsoil is yellowish brown sandy loam and channery sandy loam 25 inches thick. The substratum is dark yellowish brown, brownish yellow, and strong brown channery and very channery sandy loam to a depth of 81 inches.

Permeability is moderately rapid, and available water capacity is moderate. Most limitations are related to surface stones in some very stony areas and to slope.

Most of the acreage of these soils is in woodland. A few small areas are used for crops.

Representative profile of Clymer sandy loam in an area of Clymer very stony sandy loam, 0 to 8 percent slopes, in woodland along Benner Run Road, 0.7 mile north of Pa–504, 8 miles west of Unionville in Rush Township:

O2—2 inches to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 1 inch; very dark brown (10YR 2/2) sandy loam; weak medium granular structure; very friable, nonsticky and nonplastic; 10 percent coarse fragments; extremely acid; abrupt smooth boundary.

A2—1 inch to 3 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; 10 percent coarse fragments; extremely acid; abrupt smooth boundary.

B1—3 to 10 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; 10 percent coarse fragments; extremely acid; gradual wavy boundary.

B21t—10 to 20 inches; yellowish brown (10YR 5/8) channery sandy loam; weak medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 20 percent coarse fragments; few faint clay films in pores and bridging of sand grains; extremely acid; gradual wavy boundary.

B22t—20 to 28 inches; yellowish brown (10YR 5/8) channery sandy loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; few faint clay films lining pores and bridging sand grains; extremely acid; gradual wavy boundary.

C1—28 to 52 inches; dark yellowish brown (10YR 4/4) and brownish yellow (10YR 6/6) channery sandy loam; massive; friable, nonsticky and nonplastic; 40 percent coarse fragments; common faint clay films lining pores and bridging sand grains; extremely acid; clear wavy boundary.

IIC2—52 to 81 inches; dark yellowish brown (10YR 4/4), brownish yellow (10YR 6/6), and strong brown (7.5YR 5/6) very channery sandy loam; weak medium platy structure; friable, nonsticky and slightly plastic; 60 percent coarse fragments; common faint clay films lining pores and bridging sand grains; common prominent black coatings; very strongly acid.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock is more than 5 feet. Coarse fragments, mostly gray and brown sandstone, make up as much as 35 percent of the solum and as much as 20 to 85 percent of the C horizon. If these soils are not limed, reaction ranges from strongly acid to extremely acid throughout.

In undisturbed areas, these soils have a thin, black (10YR 2/1) or very dark brown (10YR 2/2) A1 horizon. The A2 horizon dominantly is gray (10YR 5/1) to yellowish brown (10YR 5/6). The Ap horizon, if present, is very dark grayish brown (10YR 3/2) to brown (10YR 5/3). The B horizon mainly is dark yellowish brown (10YR 4/4) to brownish yellow (10YR 6/8) or strong brown (7.5YR 5/8). It is sandy loam, loam, sandy clay loam, or clay loam, and it is channery in places. The C horizon is dark yellowish brown (10YR 4/4) to reddish yellow (7.5YR 6/6). It is similar to the B horizon in texture, but it is very channery in places.

Clymer soils are closely associated with the deep, well drained Hazleton soils; the deep, moderately well drained Buchanan soils; and the deep, poorly drained Andover soils. Clymer soils are near the moderately deep well drained Dekalb and Gilpin soils. They have more clay in the B horizon and contain fewer coarse fragments throughout than Hazleton soils. Clymer soils are similar to Ungers soils in drainage and depth to bedrock. They are not so red as Ungers soils.

ClB—Clymer sandy loam, 3 to 8 percent slopes. This gently sloping soil is mainly in convex areas on mountaintops. Areas generally range from 5 to 100 acres in size. Runoff is medium, and the erosion hazard is slight to moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, sloping, channery, or very stony Clymer soils. Also included are a few small areas of soils that are similar to Clymer soils but that contain more than 35 percent coarse fragments throughout. Small areas of Hazleton, Buchanan, Dekalb, and Leetonia soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. Although suitability for crops

is excellent, very little of the acreage of this soil is cultivated because most areas are inaccessible.

This soil has few limitations. Capability subclass IIe.

ClC—Clymer sandy loam, 8 to 15 percent slopes. This sloping soil is mainly on convex upper sides of mountaintops. Areas generally range from 3 to 50 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, channery, or very stony Clymer soils. Also included are a few small areas of soils that are similar to Clymer soils but that contain more than 35 percent coarse fragments throughout. Small areas of Hazleton, Buchanan, Dekalb, and Leetonia soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. It is also very well suited to crops, but very little of the acreage is cultivated because most areas are inaccessible.

Most limitations are caused by slope. Capability subclass IIIe.

CvB—Clymer very stony sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is mainly on convex mountaintops. Areas generally range from 5 to 200 acres in size. Runoff is medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of sloping, nonstony, or extremely stony Clymer soils. Also included are a few small areas of soils that are similar to Clymer soils but that contain more than 35 percent coarse fragments throughout. Small areas of Hazleton, Buchanan, Leetonia, and Dekalb soils are also included.

Nearly all of the acreage is in woodland. This soil is very well suited to woodland. Because of the very stony surface and inaccessibility, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness. Capability subclass VIs.

CvD—Clymer very stony sandy loam, 8 to 25 percent slopes. This sloping to moderately steep soil is mainly on convex upper sides of mountaintops. Areas generally range from 5 to 100 acres in size. Runoff is medium to rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of gently sloping, steep, nonstony, or extremely stony Clymer soils. Also included are a few small areas of soils that are similar to Clymer soils but that contain more than 35 percent coarse fragments throughout. Small areas of Hazleton, Dekalb, and Leetonia soils are also included.

Nearly all of the acreage is in woodland. This soil is very well suited to woodland. Because of the very stony surface and inaccessibility, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness and slope. Capability subclass VIs.

Dekalb Series

The Dekalb series consists of moderately deep, well drained soils that formed in sandstone residuum. These steep and very steep soils are in convex positions on uplands.

In a representative profile in woodland, 2 inches of organic material covers a surface layer of very dark gray channnery sandy loam about 2 inches thick. The subsurface layer is light brownish gray channery sandy loam 2 inches thick. The subsoil is yellowish brown and brownish yellow channery and very channery sandy loam 21 inches thick. The substratum is yellowish brown very channery loamy sand 11 inches thick. Hard gray sandstone bedrock is at a depth of 36 inches.

Permeability is moderately rapid, and available water capacity is very low or low. Most limitations are related to slope, moderate depth to sandstone bedrock, the many stones on the surface in most areas, and the many coarse fragments throughout.

Most of the acreage of these soils is in woodland.

In Centre County, Dekalb soils are mapped only in an association with very steep Hazleton soils.

Representative profile of Dekalb channery sandy loam in an area of Hazleton-Dekalb association, very steep, in woodland 500 feet north of Pa–504, 1.5 miles east of Black Moshannon Lake in Rush Township:

O1—2 inches to 1 inch; undecomposed hardwood leaf litter.

O2—1 inch to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 2 inches; very dark gray (10YR 3/1) channery sandy loam; weak fine granular structure; friable, nonsticky and nonplastic; 40 percent coarse fragments; extremely acid; abrupt smooth boundary.

A2—2 to 4 inches; light brownish gray (10YR 6/2) channery sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; 40 percent coarse fragments; extremely acid; clear wavy boundary.

B1—4 to 9 inches; yellowish brown (10YR 5/6) channery sandy loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 45 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21—9 to 20 inches; brownish yellow (10YR 6/6) very channery sandy loam; weak medium and coarse subangular blocky structure; friable, slightly sticky and nonplastic; 50 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22—20 to 25 inches; brownish yellow (10YR 6/8) very channery sandy loam; weak medium subangular blocky structure; very friable, slightly sticky and nonplastic; 60 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—25 to 36 inches; yellowish brown (10YR 5/6) very channery loamy sand; single grained; loose, nonsticky and nonplastic;

90 percent coarse fragments; very strongly acid; gradual wavy boundary.

R—36 inches; hard gray sandstone bedrock.

The solum is 20 to 40 inches thick. Depth to bedrock ranges from 20 to 40 inches. Content of sandstone coarse fragments ranges from 20 to 60 percent in the solum and from 50 to 90 percent or more in the C horizon. Reaction is extremely acid or strongly acid throughout.

In undisturbed areas, these soils have thin A1 and A2 horizons that are generally covered by a thin organic layer. The A1 horizon is black (10YR 2/1) to very dark grayish brown (10YR 3/2), and the A2 horizon is gray (10YR 5/1) to light yellowish brown (10YR 6/4). The A horizon is channery or very channery loam or sandy loam. The B horizon is yellowish brown (10YR 5/4) to reddish yellow (7.5YR 6/8). It is channery or very channery loam or sandy loam. The C horizon is yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6). It is very channery sandy loam or loamy sand.

Dekalb soils are associated with the deep, well drained Hazleton and Clymer soils and the deep, moderately well drained Buchanan soils.

Dunning Series

The Dunning series consists of deep, very poorly drained soils that formed in alluvium washed from uplands underlain by limestone and shale. These nearly level soils are on flood plains.

In a representative profile the surface layer is very dark gray silty clay loam about 3 inches thick. The subsurface layer is black silty clay loam 12 inches thick. The subsoil is 35 inches thick. It is dark greenish gray and gray silty clay and silty clay loam that has olive, yellowish brown, and light olive brown mottles. The substratum is gray silty clay that has olive and light olive brown mottles to a depth of 66 inches.

Permeability is slow, and available water capacity is high. A high water table is at the surface during wet periods, and flooding is frequent. Most limitations are related to frequent flooding, the high water table, and slow permeability.

Most of the acreage of these soils is idle or used for wildlife habitat.

Representative profile of Dunning silty clay loam, in an idle area, 110 feet west of T–366, 525 feet north of its junction with U.S. 322, 1.5 miles east of Boalsburg in Harris Township (engineering samples BK–36991 and BK–36992):

A11—0 to 3 inches; very dark gray (10YR 3/1) silty clay loam; weak fine granular structure; friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

A12—3 to 15 inches; black (10YR 2/1) silty clay loam; weak fine granular structure; friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

B1g—15 to 19 inches; dark greenish gray (5GY 4/1) silty clay; common medium faint olive (5Y 4/3) mottles; moderate coarse prismatic structure parting to moderate fine blocky; firm, slightly sticky and plastic; neutral; gradual wavy boundary.

B21g—19 to 36 inches; gray (N 5/0) silty clay; common coarse distinct olive (5Y 4/4) and yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; firm, sticky and plastic; few faint clay films in pores; neutral; gradual wavy boundary.

B22g—36 to 50 inches; gray (N 5/0) silty clay loam; many medium distinct light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; firm, sticky and plastic; common faint clay films in pores; mildly alkaline; gradual wavy boundary.

Cg—50 to 66 inches; gray (N 5/0) silty clay; common medium distinct olive (5Y 5/3) and light olive brown (2.5Y 5/6) mottles; massive; firm, slightly sticky and plastic; neutral; abrupt wavy boundary.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 6 feet. Reaction ranges from medium acid to mildly alkaline throughout.

The A horizon is very dark gray (10YR 3/1) to black (N 2/0). The B horizon is gray (10YR 6/1) to dark greenish gray (5GY 4/1) or dark gray (N 4/0), and it is mottled. It is generally silty clay or silty clay loam. The C horizon is similar to the B horizon in color and texture. In some areas, a IIC horizon of loam, sandy loam, or gravelly loam is below a depth of 40 inches.

The Dunning soils are closely associated on flood plains with the deep, well drained Chagrin soils; the deep, moderately well drained Lindside soils; and the deep, poorly drained Melvin and Atkins soils.

Du—Dunning silty clay loam. This nearly level soil is in flat areas on flood plains. Areas generally range from 2 to 20 acres in size. Runoff is very slow to ponded, and the erosion hazard is slight unless scouring occurs during flooding.

Included with this soil in mapping are a few small areas of soils that are similar to Dunning soils but that contain less clay and more coarse fragments throughout. Small areas of Melvin, Atkins, and Lindside soils are also included.

Most of the acreage is idle or used for wildlife habitat. If drained, this soil is well suited to crops or pasture. Because the soil is generally very wet, few crops are suited.

Most limitations are related to frequent flooding, caused by stream overflow or localized ponding, to the high water table, and to slow permeability. Capability subclass IVw.

Edom Series

The Edom series consists of deep, well drained soils that formed in residuum of shale and some limestone. These nearly level to moderately steep soils are on uplands in the limestone valleys.

In a representative profile in an arboretum, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil is strong brown and yellowish brown silty clay loam, clay, and shaly clay 22 inches

thick. The substratum is yellowish brown very shaly silty clay 18 inches thick. Interbedded calcareous shale and limestone bedrock is at a depth of 47 inches.

Permeability is moderate, and available water capacity is moderate to high. Most limitations are related to slope and to the 3½ to 6 foot depth to rippable bedrock. Ground water pollution is a hazard if the soil is used for waste disposal.

Most of the acreage of these soils is in cropland.

Representative profile of Edom silt loam, 8 to 15 percent slopes, in Penns Valley Area School Arboretum, 1,500 feet southeast of Pa–45 at the entrance to the elementary school, 1.4 miles west of Millheim in Penn Township:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium granular structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid; abrupt smooth boundary.

B1t—7 to 12 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine and medium subangular blocky structure; firm, sticky and plastic; 10 percent coarse fragments; few faint clay films on ped faces and in pores; medium acid; clear smooth boundary.

B21t—12 to 19 inches; strong brown (7.5YR 5/6) clay; strong medium subangular blocky structure; firm, sticky and plastic; 10 percent coarse fragments; common faint clay films on ped faces and in pores; slightly acid; clear wavy boundary.

B22t—19 to 29 inches; yellowish brown (10YR 5/6) shaly clay; strong medium angular blocky structure; firm, sticky and plastic; 20 percent coarse fragments; many moderate clay films on ped faces and in pores; mildly alkaline; clear wavy boundary.

C—29 to 47 inches; yellowish brown (10YR 5/6) very shaly silty clay; weak medium platy structure; firm, sticky and plastic; 65 percent coarse fragments; common faint clay films on horizontal ped faces and in pores; mildly alkaline; gradual wavy boundary.

R—47 inches; interbedded calcareous shale and thin bedded limestone bedrock.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock ranges from 3½ to 6 feet or more. Content of coarse fragments of shale or siltstone ranges from 5 to 30 percent in the solum and from 20 to 90 percent in the C horizon. Reaction ranges from strongly acid to mildly alkaline in the upper part of the solum and from medium acid to mildly alkaline in the lower part of the solum and in the C horizon.

The Ap horizon is olive brown (2.5Y 4/4) to dark brown (7.5YR 3/2). The B horizon is yellowish brown (10YR 5/6) to reddish brown (5YR 4/3). It is dominantly silty clay or clay and is shaly, but the B1 horizon is silty clay loam in places. The C horizon is generally similar to the B horizon in color. It is dominantly shaly or very shaly silty clay loam, silty clay, or clay.

Edom soils are associated with the deep, well drained Millheim soils; the deep, moderately well drained Clarksburg soils; the moderately deep, well drained Berks soils; and the shallow, well drained Weikert and Opequon soils. Edom soils have a lighter colored B horizon than Millheim soils. They are near the deep, well drained Nolin, local alluvium, soils.

EdB—Edom silt loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is on ridgetops on uplands. Areas generally range from 3 to 50 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of sloping Edom soils. Also included are a few small areas of soils that are similar to Edom soils but that are less than 40 inches deep over shale bedrock and of soils that have less clay in the subsoil and that contain more coarse fragments than Edom soils. Small areas of Millheim, Nolin, Berks, and Opequon soils are also included.

Most of the acreage is used for crops. This soil is very well suited to crops. Stripcropping and using diversion terraces and waterways to help control erosion and retain soil nutrients.

Most limitations are caused by the 3½ to 6 foot depth to rippable shale or thin bedded limestone bedrock. Ground water is a hazard if the soil is used for waste disposal. Capability subclass IIe.

EdC—Edom silt loam, 8 to 15 percent slopes. This sloping soil is on upper side slopes on uplands. Areas generally range from 3 to 40 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or silty clay loam Edom soils. Also included are a few small areas of soils that are similar to Edom soils but that are less than 40 inches deep over shale bedrock and of soils that contain more coarse fragments throughout and have less clay in the subsoil than Edom soils. Small areas of Millheim, Opequon, Berks, and Weikert soils are also included.

Most of the acreage is used for crops. This soil is well suited to crops if intensive conservation practices are used. Stripcropping and using diversion terraces and waterways that help to control erosion and retain soil nutrients.

Most limitations are caused by slope and the 3½ to 6 foot depth to rippable shale or thin bedded limestone bedrock. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIIe.

EdD—Edom silt loam, 15 to 25 percent slopes. This moderately steep soil is on side slopes on uplands. Areas generally range from 2 to 30 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping Edom soils. Also included are a few small areas of soils that are similar to Edom soils but that are less than 40 inches deep over shale bedrock and of soils that contain more coarse fragments throughout and have less clay in the subsoil than Edom soils. Small areas of Opequon, Millheim, Berks, and Weikert soils are also included.

Most of the acreage is used for pasture or permanent hay. This soil is suited to pasture and permanent hay.

In cultivated areas, such intensive conservation practices as stripcropping and use of diversion terraces and waterways must be applied to avoid excessive erosion and to retain soil nutrients.

Most limitations are caused by slope, the high erosion hazard in cultivated areas, and the 3½ to 6 foot depth to rippable shale or thin bedded limestone bedrock. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IVe.

Ernest Series

The Ernest series consists of deep, moderately well drained soils that formed in siltstone, shale, and sandstone colluvium. These gently sloping to moderately steep soils are on concave midslopes and lower foot slopes of shale hills.

In a representative profile the surface layer is dark brown channery silt loam about 8 inches thick. The upper 8 inches of the subsoil is yellowish brown channery silt loam, and the next 10 inches is brown silty clay loam that has gray and yellowish red mottles. The lower 25 inches of the subsoil is a fragipan of firm and brittle strong brown channery silty clay loam that has gray and yellowish red mottles. The substratum to a depth of 80 inches is yellowish brown channery silty clay loam that has light gray and strong brown mottles.

Permeability is moderately slow to slow, and available water capacity is moderate. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods. A fragipan is in the lower part of the subsoil. Most limitations are related to the seasonal high water table, moderately slow to slow permeability of the fragipan, slope, and surface stones in some very stony areas.

Most of the acreage of these soils is in cropland and pasture, and the rest is in woodland.

Representative profile of Ernest channery silt loam, 8 to 15 percent slopes, in pasture, 0.75 mile north of the junction of T–348 and U.S. 220 in Huston Township:

Ap—0 to 8 inches; dark brown (10YR 4/3) channery silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; medium acid; abrupt smooth boundary.

B1t—8 to 16 inches; yellowish brown (10YR 5/4) channery silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; few faint clay films in pores; medium acid; clear smooth boundary.

B2t—16 to 26 inches; brown (7.5YR 5/4) silty clay loam; common fine prominent gray (10YR 6/1) and yellowish red (5YR 4/6) mottles; moderate fine angular blocky structure; firm, sticky and plastic; 10 percent coarse fragments; common moderate clay films in pores and on ped faces; very strongly acid; clear wavy boundary.

Bx—26 to 51 inches; strong brown (7.5YR 5/6) channery silty clay loam with gray (10YR 6/1) prism faces; common fine prominent gray (10YR 6/1) and yellowish red (5YR 4/6) mottles; weak very coarse prismatic structure parting to weak thick platy; firm, brittle, sticky and plastic; 15 percent coarse fragments; common moderate clay films in pores and on ped faces; very strongly acid; clear wavy boundary.

C—51 to 80 inches; yellowish brown (10YR 5/4) channery silty clay loam; common fine prominent light gray (N 7/0) mottles and common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable, sticky and plastic; 30 percent coarse fragments; many moderate clay films in pores; very strongly acid.

The solum ranges from 40 to 60 inches or more in thickness. Depth to bedrock is more than 5 feet. Depth to the fragipan is 20 to 30 inches. Content of coarse fragments ranges from 5 to 20 percent in the upper solum and commonly reaches 30 percent in the fragipan and C horizon. If these soils are not limed, reaction is strongly acid or very strongly acid throughout.

The Ap horizon, if present, is dark grayish brown (10YR 4/2) to brown (7.5YR 5/4). The B horizon is brown (10YR 4/3) to reddish yellow (7.5YR 6/6), and it is mottled in the lower part. It is silt loam or silty clay loam, and it is channery in places. The C horizon is generally similar to the B horizon in color and texture. The hue of mottles in the C horizon is neutral in places.

Ernest soils occupy the same colluvial landscape as the deep, poorly drained Brinkerton soils. They are in close association with the moderately deep, well drained Berks and Gilpin soils and the deep, moderately well drained Wharton soils. Ernest soils have a fragipan, and Wharton soils have no fragipan. Ernest soils are similar to Albrights and Buchanan soils in drainage, but the lower part of the B horizon is yellower than that of Albrights soils, and they contain less sand and fewer coarse fragments throughout than Buchanan soils.

ErB—Ernest channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on lower foot slopes on uplands. Areas generally range from 2 to 30 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Ernest soils; of soils that have less than 15 percent coarse fragments in the surface layer; and of soils that have mottles between depths of 12 and 16 inches. Small areas of Brinkerton, Berks, Gilpin, and Wharton soils are also included.

Most of the acreage is used for crops. This soil is very well suited to most crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Stripcropping and using diversion terraces and waterways help to control erosion, retain soil nutrients, and allow tillage earlier in spring. Placing tile to drain wet spots is also needed in places.

Most limitations are caused by the seasonal high water table and the moderately slow to slow permeability of the fragipan. Capability subclass IIe.

ErC—Ernest channery silt loam, 8 to 15 percent slopes. This sloping soil is on upper foot slopes on uplands. Areas generally range from 2 to 30 acres in size.

Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Ernest soils. Also included are a few small areas of soils that have less than 15 percent coarse fragments in the surface layer and of soils that have mottles between depths of 12 and 16 inches. Small areas of Brinkerton, Berks, Gilpin, and Wharton soils are also included.

Most of the acreage is used for pasture or crops. This soil is well suited to most crops. Alfalfa and winter grain are affected by frost heaving. Because of slope and erodibility, stripcropping and using diversion terraces and waterways are necessary to control erosion and retain soil nutrients if the soil is used for crops. Placing tile to drain wet spots is also needed in places.

Most limitations are caused by slope, erosion, seasonal high water table, and moderately slow to slow permeability of the fragipan. Capability subclass IIIe.

ErD—Ernest channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on midslopes on uplands. Areas generally range from 2 to 20 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping, steep, or very stony Ernest soils and a few areas of soils that have less than 15 percent coarse fragments in the surface layer. Small areas of Berks and Gilpin soils are also included.

Most of the acreage is idle or used for pasture. Alfalfa and winter grain are affected by frost heaving. Because of slope and erodibility, the soil has limited suitability for crops, but it is suited to pasture and is very well suited to woodland. In cultivated areas, very intensive conservation practices are necessary to control erosion and retain soil nutrients.

Most limitations are caused by slope, erosion, seasonal high water table, and moderately slow to slow permeability of the fragipan. Capability subclass IVe.

EvB—Ernest very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is on lower foot slopes on uplands. Areas generally range from 2 to 30 acres in size. Runoff is medium. From 3 to 10 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of nearly level, sloping, or nonstony Ernest soils and of soils that have mottles between depths of 12 and 16 inches. Small areas of Brinkerton, Berks, Gilpin, and Wharton soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult. If cleared of trees, the soil is suited to unimproved pasture.

Most limitations are caused by surface stoniness, seasonal high water table, and moderately slow to slow permeability of the fragipan. Capability subclass VIs.

EvD—Ernest very stony silt loam, 8 to 25 percent slopes. This sloping to moderately steep soil is on midslopes and upper foot slopes on uplands. Areas generally range from 2 to 20 acres in size. Runoff is medium to rapid. From 3 to 10 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping were a few small areas of gently sloping, steep, or nonstony Ernest soils and of soils that have mottles between depths of 12 and 16 inches. Small areas of Berks, Gilpin, and Wharton soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult. If cleared of trees, the soil is suited to unimproved pasture.

Most limitations are caused by slope, surface stoniness, seasonal high water table, and moderately slow to slow permeability of the fragipan. Capability subclass VIs.

Gilpin Series

The Gilpin series consists of moderately deep, well drained soils that formed in shale and siltstone residuum. These nearly level to moderately steep soils are in mainly convex areas on uplands.

In a representative profile the surface layer is very dark brown channery silt loam about 3 inches thick. The subsurface layer is yellowish brown channery silt loam 6 inches thick. The subsoil is yellowish brown channery loam 13 inches thick. The substratum is yellowish brown very channery loam 10 inches thick. Gray shale bedrock interbedded with thin layers of coal is at a depth of 32 inches.

Permeability is moderate, and available water capacity is low to moderate. Most limitations are related to the moderate depth to rippable shale bedrock and slope.

Most of the acreage of these soils is in woodland.

Representative profile of Gilpin channery silt loam, 8 to 15 percent slopes, along the edge of an abandoned field along T–405, 1.7 miles northeast of the village of Clarence in Snow Shoe Township:

A1—0 to 3 inches; very dark brown (10YR 2/2) channery silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; 15 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—3 to 9 inches; yellowish brown (10YR 5/4) channery silt loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21t—9 to 15 inches; yellowish brown (10YR 5/6) channery loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; common faint clay films in pores and on ped faces; very strongly acid; gradual wavy boundary.

B22t—15 to 22 inches; yellowish brown (10YR

5/4) channery loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; common faint clay films in pores and on ped faces; very strongly acid; clear wavy boundary.

C—22 to 32 inches; yellowish brown (10YR 5/4) very channery loam; massive; friable, nonsticky and nonplastic; 85 percent coarse fragments; few faint clay films on coarse fragments; very strongly acid; clear wavy boundary.

R—32 inches; gray shale bedrock interbedded with thin layers of coal.

The solum ranges from 20 to 36 inches in thickness. Depth to rippable bedrock ranges from 20 to 40 inches. Coarse fragments of shale, siltstone, and sandstone make up 5 to 40 percent of the solum and 35 to 90 percent of the C horizon. If these soils are not limed, reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon, if present, is very dark grayish brown (10YR 3/2) to yellowish brown (10YR 5/4). The B horizon is generally yellowish brown (10YR 5/4) to strong brown (7.5YR 5/8). It is heavy silt loam, heavy loam, or light silty clay loam and is shaly or channery. The C horizon is dark brown (7.5YR 4/4) to yellowish brown (10YR 5/6) or light olive brown (2.5Y 5/6). It is generally very shaly or very channery silt loam or loam.

Gilpin soils are associated with the deep, moderately well drained Wharton soils; the deep, somewhat poorly drained Cavode soils; the deep, poorly drained Armagh soils; and the deep, well drained Rayne soils.

GlB—Gilpin channery silt loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is in convex to plane areas on uplands. Areas generally range from 5 to 60 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of sloping and very stony Gilpin soils and of soils that have less than 15 percent coarse fragments in the surface layer. Small areas of Wharton, Rayne, and Cavode soils are also included.

Most of the acreage is in woodland because areas of this soil are inaccessible. The soil is very well suited to woodland. It is well suited to crops. Because the soil is only moderately deep, intensive conservation practices are necessary to control erosion and retail soil nutrients.

Most limitations are caused by the moderate depth to rippable bedrock. Capability subclass IIe.

GlC—Gilpin channery silt loam, 8 to 15 percent slopes. This sloping soil is in convex areas on ridgetops on uplands. Areas generally range from 5 to 80 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Gilpin soils and of soils that have less than 15 percent coarse fragments in the surface layer. Small areas of Rayne and Wharton soils are also included.

Most of the acreage is in woodland because areas of this soil are inaccessible. The soil is very well suited to woodland. It is suited to limited pasture and crops. Because of the moderate depth and slope, very intensive conservation practices are necessary to control erosion and retain soil nutrients.

Most limitations are caused by moderate depth to rippable bedrock and slope. Capability subclass IIIe.

GlD—Gilpin channery silt loam, 15 to 25 percent slopes. This moderately steep soil is in convex areas on sides of ridges on uplands. Areas generally range from 5 to 50 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping, steep, or very stony Gilpin soils and of soils that have less than 15 percent coarse fragments in the surface layer. Small areas of Rayne and Wharton soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. Because of inaccessibility, moderate depth to bedrock, and slope, very little of the soil is used for pasture or crops.

Most limitations are related to slope and moderate depth to rippable bedrock. Capability subclass IVe.

Hagerstown Series

The Hagerstown series consists of deep, well drained soils that formed in limestone residuum. These nearly level to very steep soils are on uplands in limestone valleys.

In a representative profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil is yellowish red and reddish brown silty clay, clay, and silty clay loam 37 inches thick. The substratum is yellowish brown clay loam 30 inches thick. Limestone bedrock is at a depth of 75 inches.

Permeability is moderate, and available water capacity is high. Most limitations are related to slope, possible sinkhole formation, erodibility, and clayey layers in the subsoil. Ground water pollution is a hazard if the soil is used for waste disposal.

Most of the acreage of these soils is in cropland or pasture.

Representative profile of Hagerstown silt loam, 3 to 8 percent slopes, in pasture, 150 feet northeast of L.R. 14029, 0.3 mile northwest of its junction with Pa–550 at Zion in Walker Township:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; abrupt smooth boundary.

B21t—8 to 14 inches; yellowish red (5YR 5/6) silty clay; moderate fine and medium subangular blocky structure; friable, sticky and plastic; 2 percent coarse fragments; common faint clay films in pores and on ped faces; slightly acid; clear smooth boundary.

B22t—14 to 31 inches; yellowish red (5YR 4/6) clay; moderate medium angular blocky structure; firm, sticky and plastic; 2 percent coarse fragments; many moderate clay films in pores and on ped faces; common prominent black coatings on ped

faces; slightly acid; clear wavy boundary.

B23t—31 to 45 inches; reddish brown (5YR 4/4) silty clay loam; weak fine and medium subangular blocky structure; friable, sticky and plastic; 10 percent coarse fragments; few faint clay films on ped faces; many moderate clay films in pores; slightly acid; clear wavy boundary.

C—45 to 75 inches; yellowish brown (10YR 5/4) clay loam; weak fine subangular blocky structure; very friable, slightly sticky and slightly plastic; 10 percent coarse fragments; few faint clay films in pores; neutral; clear wavy boundary.

R—75 inches; limestone bedrock.

The solum ranges from 40 to 72 inches in thickness. Depth to bedrock ranges from 3½ to 7 feet or more. The content of coarse fragments ranges to as much as 15 percent. If these soils are not limed, reaction is strongly acid or very strongly acid in the upper part of the solum and strongly acid to neutral in the lower part.

The Ap horizon is dark grayish brown (10YR 4/2) to reddish brown (5YR 5/4). It is silt loam or silty clay loam. The Bt horizon is mainly yellowish red (5YR 5/6) to reddish brown (2.5YR 4/4) but has hue of 7.5YR in places. It is dominantly clay or silty clay but is silty clay loam in places. The C horizon is dark yellowish brown (10YR 3/4) to light red (2.5YR 6/8). It is loam or silt loam to clay.

Hagerstown soils are associated with the shallow, well drained Opequon soils; the deep, well drained Hublersburg, Murrill, Millheim, and Edom soils; and the deep, moderately well drained Clarksburg soils. Hagerstown soils are less acid than Hublersburg soils, have more clay in the upper part of the B horizon than Murrill soils, and have a thicker solum and a redder B horizon than Edom and Millheim soils. Hagerstown soils are near the deep, well drained Nolin soils, local alluvium.

HaA—Hagerstown silt loam, 0 to 3 percent slopes. This nearly level soil is on valley floors on limestone uplands. Areas generally range from 3 to 40 acres in size. Runoff is slow, and the erosion hazard is slight.

Included with this soil in mapping are a few small areas of gently sloping Hagerstown soils and of soils that have more than 15 percent coarse fragments in the lower part of the subsoil and in the substratum. Also included are a few small areas of soils that are similar to Hagerstown soils but that have a yellower subsoil that is clay loam in the lower part. Small areas of Nolin, Hublersburg, and Opequon soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Minimum tillage and cover crops help control erosion and retain soil nutrients.

Most limitations are caused by the clayey layer in the subsoil and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability class I.

HaB—Hagerstown silt loam, 3 to 8 percent slopes. This gently sloping soil is on valley floors on limestone uplands. Areas generally range from 3 to 100 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level, sloping, or severely eroded Hagerstown soils, of soils that have more than 15 percent coarse fragments in the lower part of the subsoil and in the substratum, and of soils that have bedrock between depths of 20 and 40 inches. Also included are a few small areas of soils that are similar to Hagerstown soils but that have a yellower subsoil that is clay loam in the lower part. Small areas of Opequon, Hublersburg, and Nolin soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping and using diversion terraces and waterways help control erosion and retain soil nutrients.

Most limitations are caused by clayey layers in the subsoil and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIe.

HaC—Hagerstown silt loam, 8 to 15 percent slopes. This sloping soil is on side slopes of limestone valley ridges. Areas generally range from 3 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but bedrock is generally 12 to 15 inches closer to the surface.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or severely eroded Hagerstown soils, of soils that have more than 15 percent coarse fragments in the lower part of the subsoil and in the substratum, and of soils that have bedrock between depths of 20 and 40 inches. Also included are a few small areas of soils that are similar to Hagerstown soils but that have a yellower subsoil that is clay loam in the lower part. Small areas of Opequon, Hublersburg, and Edom soils are also included.

Most of the acreage is used for permanent hay or crops. The soil is excellently suited to permanent hay or crops. If the soil is cultivated, the slope makes intensive conservation practices, such as stripcropping, diversion terraces, and waterways, necessary to avoid excessive erosion and to retain soil nutrients.

Most limitations are caused by the slope, clayey layer in the subsoil, and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIIe.

HcB—Hagerstown silty clay loam, 3 to 8 percent slopes. This gently sloping soil is on valley floors of limestone uplands. Areas generally range from 3 to 50 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but bedrock is generally 12 to 15 inches closer to the surface.

Included with this soil in mapping are a few small areas of nearly level, sloping, or severely eroded Hagerstown soils and of soils that have bedrock between depths of 20 and 40 inches. Also included are a few small areas of soils that are similar to Hagerstown soils but that have more than 15 percent coarse fragments in the lower part of the subsoil and in the substratum and that are clay loam in the lower part of the

subsoil. Small areas of Opequon and Nolin soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients. Tilling the soil at the proper moisture content is necessary to prevent clodding of the surface.

Most limitations are caused by the silty clay loam surface layer, clayey layers in the subsoil, and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIe.

HcC—Hagerstown silty clay loam, 8 to 15 percent slopes. This sloping soil is on upper side slopes of limestone valley ridges. Areas generally range from 3 to 40 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but bedrock is generally 15 to 25 inches closer to the surface.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or severely eroded Hagerstown soils and of soils that have bedrock between depths of 20 and 40 inches. Also included are a few small areas of soils that are similar to Hagerstown soils but that have more than 15 percent coarse fragments in the lower part of the subsoil and in the substratum and that are clay loam in the lower part of the subsoil. Small areas of Opequon and Edom soils are also included.

Most of the acreage is used for permanent hay or crops. This soil is excellently suited to permanent hay or crops. In cultivated areas, intensive conservation practices such as stripcropping, diversion terraces, and waterways are needed to help control erosion and to retain soil nutrients. Tilling this soil at the proper moisture content is necessary to prevent clodding of the surface.

Most limitations are caused by the slope, the clayey layer in the subsoil, the silty clay loam surface layer, and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIIe.

HcD—Hagerstown silty clay loam, 15 to 25 percent slopes. This moderately steep soil is on side slopes of limestone valley ridges. Areas generally range from 3 to 30 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but bedrock is generally 18 to 30 inches closer to the surface.

Included with this soil in mapping are a few small areas of sloping and severely eroded Hagerstown soils. Also included are a few small areas of soils that are similar to Hagerstown soils but that have bedrock between depths of 20 and 40 inches and of soils that have more than 15 percent coarse fragments in the lower part of the subsoil and in the substratum and that are clay loam in the lower part of the subsoil. Small areas of Opequon and Edom soils are also included.

Most of the acreage is used for permanent hay or crops. This soil is very well suited to permanent hay or crops. In cultivated areas, very intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and to retain soil nutrients. Tilling this soil at the proper moisture content is necessary to prevent clodding of the surface.

Most limitations are caused by slope, erodibility, the silty clay loam surface layer, the clayey layer in the subsoil, and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IVe.

Hazleton Series

The Hazleton series consists of deep, well drained soils that formed in sandstone residuum. These nearly level to very steep soils are on mountains.

In a representative profile in woodland, 3 inches of organic matter covers a surface layer of black channery sandy loam about 1 inch thick. The subsurface layer is grayish brown channery sandy loam 7 inches thick. The subsoil is yellowish brown channery and very channery sandy loam 27 inches thick. The substratum is brown very channery sandy loam to a depth of 60 inches.

Permeability is moderately rapid to rapid, and available water capacity is low to moderate. Most limitations are related to the many coarse fragments throughout the soils, slope, and surface stones in some extremely stony areas.

Most of the acreage of these soils is in woodland.

Representative profile of Hazleton channery sandy loam in an area of Hazleton extremely stony sandy loam, moderately steep, in woodland, along a trail, 1,500 feet southeast of Moshannon Creek, 4.5 miles northwest of Philipsburg, beyond the end of T–535 in Rush Township:

O1—3 inches to 1 inch; hardwood leaf litter.

O2—1 inch to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 1 inch; black (10YR 2/1) channery sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; 25 percent coarse fragments; extremely acid; abrupt smooth boundary.

A2—1 inch to 8 inches; grayish brown (10YR 5/2) channery sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; 30 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B1—8 to 17 inches; yellowish brown (10YR 5/4) channery sandy loam; weak fine and medium subangular blocky structure; very friable, nonsticky and nonplastic; 40 percent coarse fragments; very strongly acid; clear wavy boundary.

B2—17 to 24 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak fine and medium subangular blocky structure; very friable, nonsticky and nonplastic; 50 percent coarse fragments; strongly acid; clear wavy boundary.

B3—24 to 35 inches; yellowish brown (10YR 5/4) very channery sandy loam; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; 70 percent

coarse fragments; very strongly acid; gradual wavy boundary.

C—35 to 60 inches; brown (10YR 5/3) very channery sandy loam; massive; very friable, nonsticky and nonplastic; 80 percent coarse fragments; very strongly acid.

The solum is from 25 to 45 inches thick. Depth to bedrock ranges from 3½ to 7 feet or more. Content of coarse fragments of gray and brown sandstone ranges from 10 to 75 percent in the solum and from 35 to 80 percent in the C horizon. Reaction ranges from strongly acid to extremely acid throughout.

In undisturbed areas, these soils have a thin, black (10YR 2/1) to very dark grayish brown (10YR 3/2) A1 horizon that is generally covered by a thin, black organic horizon. The A2 horizon is generally grayish brown (10YR 5/2) or brown (10YR 5/3). The A horizon is channery or very channery sandy loam or loam. The B horizon is generally yellowish brown (10YR 5/4 or 5/6) or strong brown (7.5YR 5/6) channery or very channery sandy loam or loam. The B3 horizon, however, is very channery loamy sand in places. The C horizon is variable in color, but hue generally centers on 10YR. The C horizon ranges from channery loam to very channery loamy sand.

Hazleton soils are associated with the moderately deep, well drained Dekalb soils; the deep, well drained Clymer, Laidig, and Leetonia soils; the deep, moderately well drained Buchanan soils; and the deep, poorly drained Andover soils. Hazleton soils have less sand than Leetonia soils, contain more coarse fragments throughout than Clymer soils, and do not have the fragipan that is characteristic of Laidig soils.

HhB—Hazleton channery sandy loam, 3 to 8 percent slopes. This gently sloping soil is mainly in convex areas on broad mountaintops. Areas generally range from 5 to 80 acres in size. Runoff is medium, and the erosion hazard is slight to moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Hazleton soils and small areas of Clymer, Buchanan, and Dekalb soils. Also included are a few small areas of soils that are similar to Hazleton soils but that have a layer of clay accumulation in the subsoil.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. Although suitability for crops is excellent, very little of the acreage of this soil is cultivated because areas are inaccessible.

Most limitations are caused by the many coarse fragments throughout the profile. Capability subclass IIe.

HhC—Hazleton channery sandy loam, 8 to 15 percent slopes. This soil is mainly in convex areas on upper mountain ridges. Areas generally range from 3 to 50 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Hazleton soils and small areas of Clymer, Dekalb, and Buchanan soils. Also included are a few small areas of soils that are similar to Hazleton soils but that have a layer of clay accumulation in the subsoil.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. The soil is very well suited to crops, but very little of the acreage of this soil is cultivated because areas are inaccessible.

Most limitations are caused by slope and the many coarse fragments throughout the profile. Capability subclass IIIe.

HhD—Hazleton channery sandy loam, 15 to 25 percent slopes. This moderately steep soil is mainly on convex sides of mountain ridges. Areas generally range from 3 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping, steep, or very stony Hazleton soils and small areas of Dekalb and Clymer soils.

Nearly all of the acreage is in woodland. This soil is suited to woodland. Inaccessibility and slope limit other farm uses.

Most limitations are caused by slope and the many coarse fragments throughout the profile. Capability subclass IVe.

HSB—Hazleton extremely stony sandy loam, gently sloping. This soil is mainly in convex areas on mountaintops. Slopes are 0 to 8 percent. Areas generally range from 5 to 100 acres in size. Runoff is slow to medium. From 15 to 50 percent of the surface is covered by stones 10 to 30 inches in diameter.

Included with this soil in mapping are areas of sloping, nonstony, or very stony Hazleton soils and small areas of Dekalb, Clymer, Buchanan, Andover, and Leetonia soils. These inclusions make up 40 percent of the unit. Because this soil is in remote, inaccessible, wooded parts of the county, areas were not investigated so thoroughly as areas of nonstony Hazleton soils; therefore, areas mapped as this soil contain more inclusions than areas of nonstony Hazleton soils.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. Because of the extremely stony surface layer and inaccessibility, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the many stones on the surface and the many coarse fragments throughout the profile. Capability subclass VIIs.

HSD—Hazleton extremely stony sandy loam, moderately steep. This soil is mainly on convex sides of mountain ridges. Slopes are 8 to 25 percent. Areas generally range from 5 to 100 acres in size. Runoff is medium to rapid. From 15 to 50 percent of the surface is covered by stones 10 to 30 inches in diameter. This soil has the profile described as representative of the series.

Mainly included with this soil in mapping are gently sloping, steep, nonstony, or very stony Hazleton soils and small areas of Dekalb, Clymer, Buchanan, Laidig, and Leetonia soils. These inclusions make up 40 percent of the unit. Because this soil is in remote, inaccessible, wooded parts of the county, areas were not investigated so thoroughly as areas of nonstony Hazleton soils; therefore, areas mapped as this soil contain more inclusions than areas of nonstony Hazleton soils.

Nearly all of the acreage is used for woodland. This soil is well suited to woodland. Because of the extremely stony surface layer and inaccessibility, this soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the many stones on the surface, slope, and the many coarse fragments throughout the profile. Capability subclass VIIs.

HTF—Hazleton-Dekalb association, very steep. This association is on mountainsides. Slopes are 25 to 80 percent (fig. 11). The soils could have been mapped separately, but they were mapped together because the surface is extremely stony and expected use and management are influenced by the stones. The association is about 60 percent Hazleton soils, 20 percent Dekalb soils, and 20 percent included soils. Areas generally range from 10 to 300 acres in size. Runoff is rapid to very rapid. From 3 to 50 percent of the surface is covered by stones 10 to 30 inches in diameter. The surface layer is channery or very channery loam or sandy loam.

The Hazleton soil has a profile similar to the one described as representative of the Hazleton series, but it generally contains 10 to 15 percent more coarse fragments throughout. The Dekalb soil has the profile described as representative of the Dekalb series.

Included with these soils in mapping are mainly areas of Clymer, Leetonia, and Laidig soils. Also included are a few small areas of moderately steep Hazleton and Dekalb soils, a few small areas of soils that are similar to Hazleton or Dekalb soils but in which bedrock is at a depth of less than 20 inches, a few small areas of redder soils, and a few small areas that have more than 50 percent of the surface covered by stones.

Practically all of the acreage is used for woodland. This association is fairly well suited or well suited to woodland. Because of the steep and very steep slopes and the many surface stones, these soils are also well suited to wildlife habitat and esthetic uses.

Most limitations are caused by the steep and very steep slopes, surface stoniness, and variability of the depth to sandstone bedrock. Capability subclass VIIs.

Hublersburg Series

The Hublersburg series consists of deep, well drained soils that formed in cherty limestone residuum. These nearly level to moderately steep soils are on uplands in limestone valleys.

In a representative profile in a cultivated area, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is yellowish brown and strong brown silty clay loam, cherty silty clay, and silty clay 52 inches thick. The substratum is yellowish brown cherty silty clay loam to a depth of 70 inches.

Permeability is moderate, and available water capacity is high. Most limitations are related to erodi-

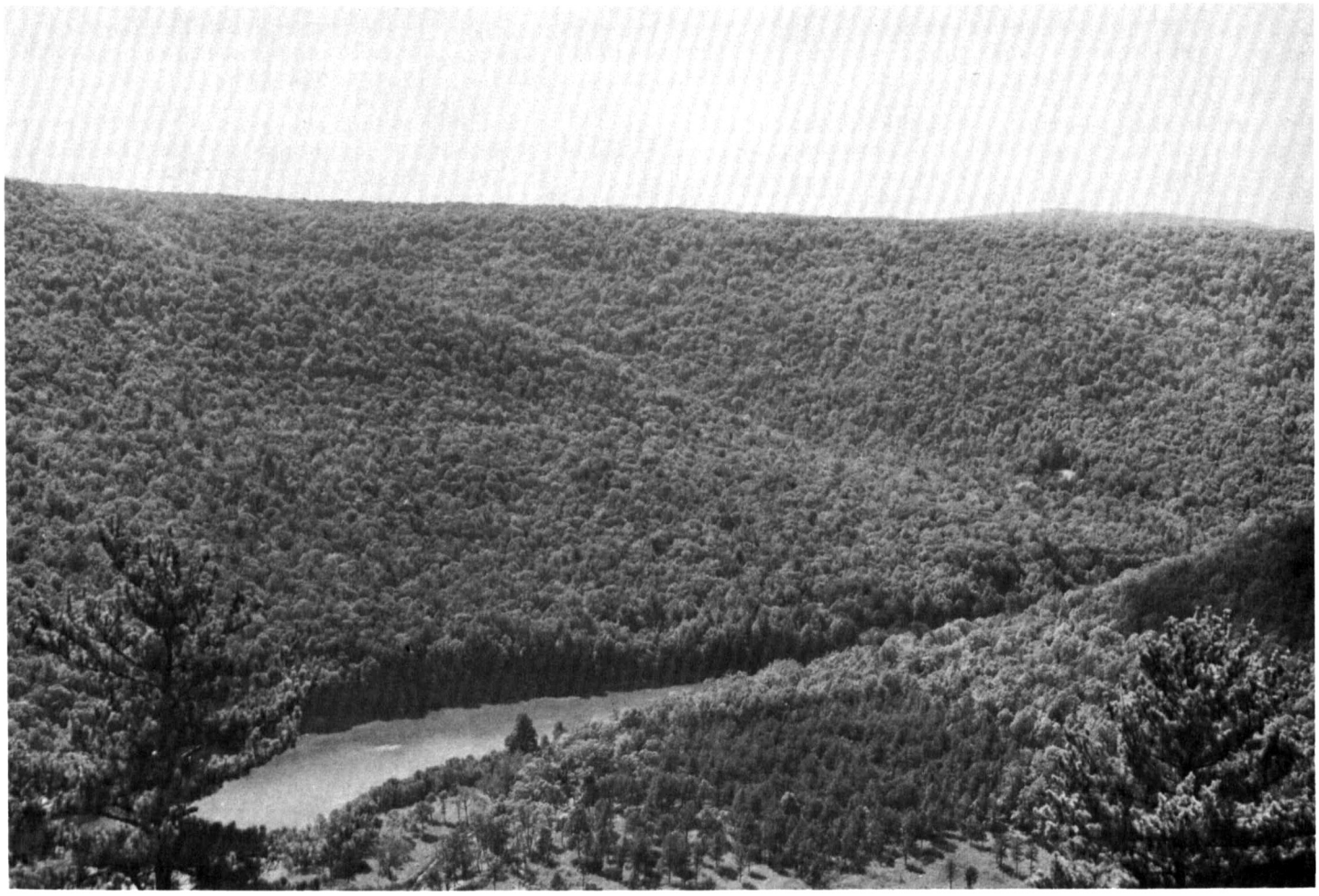

Figure 11.—An area of Hazleton-Dekalb association, very steep, along the Susquehanna River in the northern part of the county.

bility, the clayey layer in the subsoil, slope, and possible sinkhole formation. Ground water pollution is a hazard if the soils are used for waste disposal.

Most of the acreage of these soils is in cropland or pasture.

Representative profile of Hublersburg silt loam, 3 to 8 percent slopes, in cropland 20 feet south of a fencerow, 250 feet west of T–418, 0.8 mile south of its junction with Pa–45, 1.1 mile west of Old Fort in Potter Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1—9 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; medium acid; clear wavy boundary.

B21t—14 to 30 inches; yellowish brown (10YR 5/6) silty clay; moderate fine and medium subangular blocky structure; firm, sticky and plastic; 5 percent coarse fragments; common faint and moderate clay films on ped faces and in pores; few prominent black coatings on ped faces; strongly acid; gradual wavy boundary.

B22t—30 to 54 inches; yellowish brown (10YR 5/4) silty clay; moderate medium subangular blocky structure; firm, sticky and plastic; 5 percent coarse fragments; common faint clay films on ped faces and many moderate clay films in pores; few prominent black coatings on ped faces; medium acid; clear wavy boundary.

B23t—54 to 61 inches; strong brown (7.5YR 5/6) cherty silty clay; weak medium subangular blocky structure; firm, sticky and plastic; 20 percent coarse fragments; common moderate clay films on ped faces and in pores; medium acid; clear wavy boundary.

C—61 to 70 inches; yellowish brown (10YR 5/8) cherty silty clay loam; massive; friable, slightly sticky and slightly plastic; 20 percent coarse fragments; few faint clay films in pores; medium acid.

The solum ranges from 60 to 80 inches in thickness. Depth to bedrock is more than 5 feet. Content of fragments, dominantly chert, ranges to as much as 25 percent in the solum. If these soils are not limed, reaction ranges from strongly acid to slightly acid throughout.

The Ap horizon is very dark grayish brown (10YR 3/2) to brown (7.5YR 4/4). The B horizon mainly is brownish yellow (10YR 6/8) to brown (7.5YR 5/4), but the Bt horizon is reddish brown (5YR 5/4) in places. The B1 horizon is silt loam or silty clay loam, and the Bt horizon is silty clay loam to clay. The C horizon is generally similar to the B horizon in color and texture.

The reaction and base saturation of these soils are higher than is defined in the range for the Hublersburg series, but these differences do not alter use and behavior.

Hublersburg soils are associated with the deep, well drained Hagerstown, Edom, Morrison, and Murrill soils; the shallow, well drained Opequon soils; and the deep, moderately well drained Clarksburg soils. They are more acid in the lower part of the solum than Hagerstown and Edom soils and contain more clay in the upper part of the B horizon than Morrison and Murrill soils.

HuA—Hublersburg silt loam, 0 to 3 percent slopes. This nearly level soil is in broad flat areas on cherty limestone uplands. Areas generally range from 3 to 50 acres in size. Runoff is slow, and the erosion hazard is slight unless the soil is cultivated.

Included with this soil in mapping are a few small areas of gently sloping Hublersburg soils and of soils that are similar to Hublersburg soils but that have less clay in the subsoil. Small areas of Nolin, Hagerstown, and Opequon soils are also included.

Most of the acreage is used for crops. The soil is excellently suited to crops. Stripcropping helps to control erosion and retain soil nutrients.

Most limitations are caused by the clayey layer in the subsoil. Ground water pollution is a hazard if the soil is used for waste disposal. Capability class I.

HuB—Hublersburg silt loam, 3 to 8 percent slopes. This gently sloping soil is on upper side slopes of knolls in cherty limestone valleys. Areas generally range from 5 to 200 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level or sloping Hublersburg soils. Also included are a few small areas of soils that are similar to Hublersburg soils but that have less clay in the subsoil. Small areas of Nolin, Hagerstown, and Opequon soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping, diversion terraces, and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by the clayey layer in the subsoil. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIe.

HuC—Hublersburg silt loam, 8 to 15 percent slopes. This sloping soil is on hillsides in cherty limestone valleys. Areas generally range from 3 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or severely eroded Hublersburg soils. Also included are a few small areas of soils that are similar to Hublersburg soils but that have less clay in the subsoil and of soils that have bedrock within a depth of 60 inches. Small areas of Opequon and Hagerstown soils are also included.

Most of the acreage is used for permanent hay or crops. This soil is excellently suited to crops. If the soil is cultivated, intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and retain soil nutrients.

Most limitations are caused by slope and the clayey layer in the subsoil. Ground water pollution is a hazard

if the soil is used for waste disposal. Capability subclass IIIe.

HuD—Hublersburg silt loam, 15 to 25 percent slopes. This moderately steep soil is on valley side slopes on cherty limestone uplands. Areas generally range from 2 to 15 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping and severely eroded Hublersburg soils. Also included are a few small areas of soils that are similar to Hublersburg soils but that have bedrock within a depth of 60 inches and of soils that have less clay in the subsoil. Small areas of Opequon and Hagerstown soils are also included.

Most of the acreage is used for permanent hay, pasture, or crops. This soil is very well suited to crops. If the soil is cultivated, very intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and to retain soil nutrients.

Most limitations are caused by slope, erodibility, and the clayey layer in the subsoil. Ground water is a hazard if the soil is used for waste disposal. Capability subclass IVe.

Laidig Series

The Laidig series consists of deep, well drained soils that formed in sandstone and siltstone alluvium. These nearly level to very steep soils are on concave midslopes and lower foot slopes of mountains.

In a representative profile about 3 inches of organic material covers a surface layer of dark grayish brown channery loam about 3 inches thick. The subsoil extends to a depth of 74 inches. The upper 37 inches is strong brown and yellowish brown channery loam that has red mottles below a depth of 34 inches. The lower 34 inches is a fragipan of yellowish brown and dark yellowish brown, firm and brittle channery loam that has a few red mottles.

Permeability is moderately slow, and available water capacity is moderate. A fragipan is in the lower part of the subsoil. Most limitations are related to slope, surface stones in some extremely stony areas, and moderately slow permeability.

Most of the acreage of these soils is in woodland. Some areas are used for crops and pasture.

Representative profile of Laidig channery loam in an area of Laidig extremely stony loam, 8 to 25 percent slopes, in woodland, along a logging road 0.5 mile south of Pine Grove Mills in Ferguson Township (engineering samples 71–20701 and 71–20702):

O1—3 to 2 inches; mostly undecomposed hardwood leaf litter.

O2—2 inches to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) channery loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; 15 percent coarse fragments; strongly acid; clear wavy boundary.

B1—3 to 12 inches; strong brown (7.5YR 5/6) channery loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; 25 percent coarse fragments; strongly acid; clear wavy boundary.

B21t—12 to 20 inches; yellowish brown (10YR 5/6) channery loam; weak and moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; 35 percent coarse fragments; few faint clay films on ped faces; strongly acid; clear wavy boundary.

B22t—20 to 23 inches; strong brown (7.5YR 5/6) channery loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; few faint clay films on ped faces and in pores; strongly acid; abrupt wavy boundary.

B23t—23 to 31 inches; yellowish brown (10YR 5/4) channery loam; moderate fine subangular blocky and weak thin platy structure; firm, slightly sticky and slightly plastic; 30 percent coarse fragments; few faint clay films on ped faces and in pores; common prominent black coatings on ped faces; strongly acid; abrupt wavy boundary.

B24t—31 to 34 inches; yellowish brown (10YR 5/4) channery loam; moderate medium platy structure; friable, slightly sticky and slightly plastic; 35 percent coarse fragments; common faint clay films on ped faces; many prominent black coatings on ped faces; strongly acid; abrupt wavy boundary.

B25t—34 to 40 inches; yellowish brown (10YR 5/6) channery loam; common coarse prominent red (2.5YR 5/8) mottles; moderate fine and medium subangular blocky structure; firm, slightly sticky and slightly plastic; 15 percent coarse fragments; few faint clay films on ped faces; few prominent black coatings on ped faces; strongly acid; abrupt wavy boundary.

Bx1—40 to 59 inches; yellowish brown (10YR 5/4) channery loam; few medium prominent red (2.5YR 5/8) mottles; weak very coarse prismatic structure parting to weak medium platy and moderate medium subangular blocky; firm, brittle, slightly sticky and slightly plastic; 45 percent coarse fragments; few faint clay films on ped faces and in pores; common prominent black coatings on ped faces; strongly acid; gradual wavy boundary.

Bx2—59 to 74 inches; dark yellowish brown (10YR 4/4) channery loam; few medium prominent red (2.5YR 5/8) mottles; weak very coarse prismatic structure parting to weak medium platy and moderate medium subangular blocky; firm, brittle, slightly sticky and slightly plastic; 45 percent coarse fragments; few faint and moderate clay films on ped faces and in pores;

common prominent black coatings on ped faces; strongly acid.

The solum is 60 to 80 inches or more thick. Depth to bedrock is more than 6 feet. Depth to the fragipan ranges from 30 to 45 inches. The content of coarse fragments, mainly sandstone, ranges from 10 to 35 percent in the upper part of the solum and from 30 to 70 percent in the lower part of the solum. If these soils are not limed, reaction ranges from extremely acid to strongly acid throughout.

The A1 horizon is dominantly very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). The A2 horizon is gray (10YR 5/1) to reddish yellow (7.5YR 6/6). The B horizon above the fragipan is brown (7.5YR 4/4) to yellowish brown (10YR 5/6). The Bx horizon is dark brown (10YR 4/3) to strong brown (7.5YR 5/6) or yellowish brown (10YR 5/6). Mottles that have chroma of 3 or more are below a depth of 30 inches in places. The B horizon is dominantly channery sandy clay loam, channery loam, channery sandy loam, or channery silt loam.

Laidig soils occupy the same colluvial landscape as the deep, well drained Murrill soils; the deep, moderately well drained Buchanan soils; and the deep, poorly drained Andover soils. Laidig soils are near the deep, well drained Hazleton soils and the moderately deep, well drained Dekalb and Berks soils. Laidig soils have a fragipan, which the Murrill or Hazleton soils do not have. Laidig soils are similar to Meckesville soils in drainage and colluvial landscape position, but they are not so red and they contain more sandstone coarse fragments in the upper part of the solum.

LaB—Laidig channery loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on upper slopes on uplands. Areas generally range from 2 to 20 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation in most places.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Laidig soils. Also included are a few small areas of soils that are similar to Laidig soils but that do not have a fragipan and of soils that are underlain by shale. Small areas of Buchanan and Murrill soils are also included.

Most of the acreage is used for crops or pasture. The soil is very well suited to crops. Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by the moderately slow permeability of the fragipan. Capability subclass IIe.

LaC—Laidig channery loam, 8 to 15 percent slopes. This sloping soil is on concave side slopes on uplands. Areas generally range from 2 to 20 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation in most places.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Laidig soils. Also included are a few small areas of soils that are similar to Laidig soils but that do not have a fragipan and of soils that are underlain by shale. Small areas of Buchanan, Murrill, and Hazleton soils are also included.

Most of the acreage is used for crops or pasture. This soil is well suited to crops or pasture. In cultivated areas, intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and retain soil nutrients.

Most limitations are caused by slope and moderately slow permeability of the fragipan. Capability subclass IIIe.

LaD—Laidig channery loam, 15 to 25 percent slopes. This moderately steep soil is on concave side slopes on uplands. Areas generally range from 2 to 30 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas. This soil has a profile similar to the one described as representative of the series, but the surface layer has been disturbed by cultivation in most places.

Included with this soil in mapping are a few small areas of sloping, steep, or very stony Laidig soils. Also included are a few small areas of soils that are similar to Laidig soils but that do not have a fragipan and of soils that are underlain by shale. Small areas of Murrill, Berks, and Hazleton soils are also included.

Most of the acreage is used for permanent hay or pasture. This soil is well suited to permanent hay or pasture. In cultivated areas, very intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and retain soil nutrients.

Most limitations are caused by slope and moderately slow permeability of the fragipan. Capability subclass IVe.

LcB—Laidig extremely stony loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is on concave upper side slopes on uplands. Areas generally range from 3 to 40 acres in size. Runoff is slow to medium. From 15 to 25 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of sloping and very stony Laidig soils. Also included are a few small areas of soils that are similar to Laidig soils but that do not have a fragipan and of soils that are underlain by shale. Small areas of Buchanan and Murrill soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness and moderately slow permeability of the fragipan. Capability subclass VIIs.

LcD—Laidig extremely stony loam, 8 to 25 percent slopes. This sloping to moderately steep soil is on concave side slopes on uplands. Areas generally range from 5 to 100 acres in size. Runoff is medium to rapid. From 15 to 25 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping, steep, or very stony Laidig soils. Also included are a few small areas of soils that are similar to Laidig soils but that do not have a fragipan, of soils that are underlain by shale, and of soils that contain more than 35 percent coarse fragments

throughout. Small areas of Buchanan, Murrill, Berks, and Hazleton soils are also included.

Most of the acreage of this soil is in woodland. This soil is well suited to woodland. The many stones on the surface and slope make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness, slope, and moderately slow permeability of the fragipan. Capability subclass VIIs.

LDF—Laidig extremely stony loam, steep. This soil is on side slopes on uplands. Slopes are 25 to 60 percent. Areas generally range from 10 to 300 acres in size. Runoff is rapid to very rapid. From 15 to 35 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are areas of moderately steep, nonstony, or very stony Laidig soils and small areas of Hazleton and Berks soils; these areas make up as much as 40 percent of the unit. Because this soil is steep, areas of this mapping unit were not investigated so thoroughly as areas of less sloping Laidig soils; therefore, areas of the mapping unit contain more inclusions than areas of less sloping Laidig soils.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. Because slopes are steep to very steep and the surface layer is extremely stony, this soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the steep to very steep slopes, the many stones on the surface, and the moderately slow permeability of the fragipan. Capability subclass VIIs.

Leck Kill Series

The Leck Kill series consists of deep, well drained soils that formed in shale, siltstone, and fine grained sandstone residuum. These nearly level to very steep soils are mainly in convex areas on uplands.

In a representative profile in a cultivated area, the surface layer is dark brown channery silt loam about 8 inches thick. The subsoil is reddish brown and dark reddish brown channery silt loam 23 inches thick. The substratum is reddish brown and dark reddish brown very channery silt loam and very flaggy loam to a depth of 72 inches.

Permeability is moderately rapid, and available water capacity is moderate to high. Most limitations are related to slope and surface stones in some very stony areas.

About half of the acreage of these soils is in woodland, and most of the rest is in cropland or pasture.

Representative profile of Leck Kill channery silt loam, 15 to 25 percent slopes, in a hayfield, 200 feet north of L.R. 14009, 4 miles north of Yarnell in Curtin Township:

Ap—0 to 8 inches; dark brown (7.5YR 3/2) channery silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 25 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21—8 to 13 inches; reddish brown (2.5YR 4/4) channery silt loam; moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; strongly acid; clear smooth boundary.

B22t—13 to 18 inches; reddish brown (2.5YR 4/4) channery silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; few faint clay films on ped faces and in pores; very strongly acid; gradual smooth boundary.

B23t—18 to 31 inches; dark reddish brown (2.5YR 3/4) channery silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; many faint clay films on ped faces and in pores; very strongly acid; gradual wavy boundary.

C1—31 to 54 inches; reddish brown (2.5YR 4/4) very channery silt loam; weak thick platy structure; friable, slightly sticky and slightly plastic; 65 percent coarse fragments; common faint clay films on coarse fragments; very strongly acid; gradual wavy boundary.

C2—54 to 72 inches; dark reddish brown (2.5YR 3/4) very flaggy loam; massive; firm, slightly sticky and slightly plastic; 60 percent coarse fragments; common faint clay films in pores; very strongly acid.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock ranges from 3½ to 6 feet. The content of coarse fragments ranges from 5 to 25 percent in the surface layer and B1 horizon, if present; 10 to 40 percent in the B2 horizon; and 60 to 90 percent in the C horizon. If these soils are not limed, reaction ranges from medium acid to very strongly acid throughout.

The Ap horizon is dark brown (7.5YR 3/2) to reddish brown (2.5YR 4/4). The A horizon is channery or shaly silt loam or loam. The B horizon is yellowish red (5YR 5/6) to dusky red (10R 3/4). It is silt loam to clay loam and is shaly or channery. The C horizon is similar to the B horizon in color. It is very shaly, very channery, or very flaggy silt loam, loam, or clay loam.

Leck Kill soils are associated with the deep, well drained Meckesville and Ungers soils; the deep, moderately well drained Albrights soils; the deep, poorly drained Brinkerton soils; and the moderately deep, well drained Calvin soils. Leck Kill soils do not have the fragipan that is characteristic of Meckesville soils, and they contain less sand than Ungers soils.

LkB—Leck Kill channery silt loam, 3 to 8 percent slopes. This gently sloping soil is mainly on convex hilltops. Areas generally range from 3 to 50 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Leck Kill soils. Also included are a few small areas of soils that are similar to Leck Kill soils but that contain more than 35 percent coarse fragments throughout. Small areas of Meckesville, Albrights, and Ungers soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping and using

diversion terraces and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by the many coarse fragments throughout the profile. Capability subclass IIe.

LkC—Leck Kill channery silt loam, 8 to 15 percent slopes. This sloping soil is mainly on upper side slopes of ridges. Areas generally range from 3 to 75 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Leck Kill soils. Also included are a few small areas of soils that are similar to Leck Kill soils but that contain more than 35 percent coarse fragments throughout. Small areas of Meckesville, Calvin, Ungers, and Albrights soils are also included.

Most of the acreage is used for permanent hay or crops. This soil is very well suited to permanent hay or crops. In cultivated areas, intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and retain soil nutrients.

Most limitations are caused by slope and the many coarse fragments throughout the profile. Capability subclass IIIe.

LkD—Leck Kill channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on side slopes of ridges. Areas generally range from 2 to 50 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of sloping, steep, severely eroded, or very stony Leck Kill soils. Also included are a few small areas of soils that are similar to Leck Kill soils but that contain more than 35 percent coarse fragments throughout. Small areas of Ungers, Calvin, and Meckesville soils are also included.

Most of the acreage is used for permanent hay or pasture. This soil is well suited to permanent hay and pasture. In cultivated areas, very intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and retain soil nutrients.

Most limitations are caused by slope and the many coarse fragments throughout the profile. Capability subclass IVe.

LlB—Leck Kill very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is mainly in convex areas on ridges on uplands. Areas generally range from 2 to 30 acres in size. Runoff is slow to medium. From 3 to 15 percent of the surface is covered by stones 10 to 20 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of sloping and nonstony Leck Kill soils. Also included are a few small areas of soils that are similar to Leck Kill soils but that contain more than 35 percent coarse fragments throughout. Small areas of Albrights, Meckesville, and Ungers soils are also included.

Most of the acreage of this soil is in woodland. This soil is well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by the many stones on the surface. Capability subclass VIs.

LlD—Leck Kill very stony silt loam, 8 to 25 percent slopes. This sloping to moderately steep soil is mainly on side slopes of ridges. Areas generally range from 3 to 60 acres in size. Runoff is medium to rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of gently sloping, steep, or nonstony Leck Kill soils. Also included are a few small areas of soils that are similar to Leck Kill soils but that contain more than 35 percent coarse fragments throughout. Small areas of Meckesville, Calvin, Albrights, and Ungers soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by slope and the many stones on the surface. Capability subclass VIs.

LMF—Leck Kill and Calvin soils, steep. These soils are mainly in convex areas on uplands. Slopes are 25 to 90 percent. This mapping unit is about 45 percent Leck Kill soil and 20 percent Calvin soil. Some areas, however, are all Leck Kill soil, all Calvin soil, or any combination of the two. Areas generally range from 5 to 100 acres in size. Runoff is rapid to very rapid. As much as 15 percent of the surface is covered by stones 10 to 24 inches in diameter. The Leck Kill soil has a profile similar to the one described as representative of the Leck Kill series, but the surface has not been disturbed by cultivation. The Calvin soil has the profile described as representative of the Calvin series. The surface layer of the soils is channery or shaly silt loam or loam.

Included with these soils in mapping are areas of Ungers and Meckesville soils. Because these soils are steep, areas of this mapping unit have not been investigated so thoroughly as areas of less sloping Leck Kill soils; therefore, areas of this mapping unit contain more inclusions than areas of less sloping Leck Kill soils.

Most of the acreage is in woodland. These soils are well suited to woodland. Because of the steep and very steep slopes, the soils are better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the steep and very steep slopes and the variability of depth to rippable bedrock. Capability subclass VIIe.

Leetonia Series

The Leetonia series consists of deep, well drained soils that formed in sandstone residuum. These nearly level and sloping soils are mainly in convex areas on mountaintops.

In a representative profile in woodland, 1 inch of organic material covers a surface layer of very dark

gray flaggy loamy sand about 3 inches thick. The subsurface layer is light gray flaggy loamy sand 10 inches thick. The subsoil is strong brown flaggy loamy sand 15 inches thick. The substratum is light yellowish brown very flaggy loamy sand 18 inches thick. Hard gray sandstone bedrock is at a depth of 46 inches.

Permeability is moderately rapid, and available water capacity is very low. Most limitations are related to the many stones on the surface, the many coarse fragments throughout, droughtiness, and the 3½ to 4 foot depth to sandstone bedrock.

Most of the acreage of these soils is in woodland.

Representative profile of Leetonia flaggy loamy sand in an area of Leetonia extremely stony loamy sand, 0 to 12 percent slopes, in woodland, along Huckleberry Road, 1.3 miles northeast of its junction with L.R. 864 (Munson Road), 2 miles northwest of Black Moshannon State Park at Antes in Rush Township:

O2—1 inch to 0; black (10YR 2/1) partly decomposed organic material.

A1—0 to 3 inches; very dark gray (5YR 3/1) flaggy loamy sand; single grained; loose, nonsticky and nonplastic; 40 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—3 to 13 inches; light gray (10YR 6/1) flaggy loamy sand; weak medium granular structure; very friable, nonsticky and nonplastic; 35 percent coarse fragments; very strongly acid; abrupt wavy boundary.

B2h—13 to 28 inches; strong brown (7.5YR 5/6) flaggy loamy sand; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; 35 percent coarse fragments; very strongly acid; abrupt smooth boundary.

C—28 to 46 inches; light yellowish brown (10YR 6/4) very flaggy loamy sand; single grained; loose, nonsticky and nonplastic; 80 percent coarse fragments; extremely acid; abrupt smooth boundary.

R—46 inches; hard gray sandstone bedrock.

The solum ranges from 18 to 34 inches in thickness. Depth to bedrock ranges from 3½ to 4 feet. Content of sandstone coarse fragments averages between 35 and 60 percent in the control section. Reaction is extremely acid or very strongly acid throughout.

The A1 horizon is dark gray (5YR 4/1) to very dark brown (10YR 2/2). The A2 horizon is light gray (10YR 6/1) or gray (10YR 5/1). The Bh horizon is dark brown (10YR 3/3) to yellowish red (5YR 4/6). The B3 horizon, if present, is brown (7.5YR 5/4) to brownish yellow (10YR 6/6). The B horizon is channery, very channery, flaggy, or very flaggy sand or loamy sand. The C horizon is similar to the B horizon in color and texture, but it is yellower in places.

The Leetonia soils are associated with the deep, well drained Hazleton and Clymer soils; the moderately deep, well drained Dekalb soils; the deep, moderately well drained Buchanan soils; and the deep, poorly drained Andover soils. They contain more sand than Hazleton and Clymer soils.

LtB—Leetonia extremely stony loamy sand, 0 to 12 percent slopes. This nearly level to sloping soil is mainly in convex areas on mountaintops. Areas generally range from 5 to 100 acres in size. Runoff is slow to medium. From 15 to 50 percent of the surface is covered by stones 10 to 30 inches in diameter.

Included with this soil in mapping are a few small areas of moderately steep and very stony Leetonia soils. Also included are a few small areas of soils that are similar to Leetonia soils but that are less than 35 percent coarse fragments throughout. Small areas of Hazleton, Clymer, and Buchanan soils are also included.

Most of the acreage is in woodland. Because of droughtiness and the many stones on the surface, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the many stones on the surface, droughtiness, the many coarse fragments throughout, and the 3½ to 4 foot depth to bedrock. Capability subclass VIIs.

Leetonia Variant

The Leetonia variant consists of deep, well drained soils that formed in sandstone residuum. These gently sloping to sloping soils are on hilltops on uplands.

In a representative profile in a wooded area, 1 inch of organic material covers a surface layer of black sand 2 inches thick. The subsurface layer is pinkish gray sand 7 inches thick. The upper 3 inches of the subsoil is dark brown to brown sand, and the lower 30 inches is light yellowish brown, yellowish brown, and yellowish red loamy sand and sandy loam. The substratum is yellowish red loamy sand that has brown streaks to a depth of 60 inches.

Permeability is rapid, and available water capacity is very low. Most limitations are related to the sandy texture, the rapid permeability, and the droughtiness.

Most of the acreage of these soils is in woodland.

Representative profile of Leetonia sand, variant, 3 to 8 percent slopes, in woodland, 1,200 feet south of U.S. 322 at its junction with the west end of the State College bypass in Patton Township:

O2—1 inch to 0; decaying forest litter.

A1—0 to 2 inches; black (10YR 2/1) sand; single grained; loose, nonsticky and nonplastic; extremely acid; abrupt smooth boundary.

A2—2 to 9 inches; pinkish gray (7.5YR 6/2) sand; single grained; loose, nonsticky and nonplastic; extremely acid; abrupt wavy boundary.

Bir—9 to 12 inches; dark brown (7.5YR 3/2) sand in the upper part of the horizon grading to brown (7.5YR 5/4) sand in the lower part; weak fine granular structure; very friable, nonsticky and nonplastic; 10 percent coarse fragments; extremely acid; clear wavy boundary.

B21—12 to 21 inches; light yellowish brown (2.5Y 6/4) loamy sand; single grained; very friable, nonsticky and nonplastic; 10 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22—21 to 32 inches; yellowish brown (10YR 5/4) loamy sand; single grained; very friable, nonsticky and nonplastic; 10 percent coarse fragments; horizontal bands

and streaks of iron; very strongly acid; clear irregular boundary.

B23—32 to 42 inches; yellowish red (5YR 5/6) sandy loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; very strongly acid; clear irregular boundary.

C—42 to 60 inches; yellowish red (5YR 5/6) loamy sand that has brown (7.5YR 5/4) streaks; single grained; very friable, nonsticky and nonplastic; 10 percent coarse fragments; very strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 6 feet. Content of sandstone coarse fragments, some of which are rich in iron, ranges to as much as 15 percent in the solum and from 5 to 40 percent in the C horizon. Reaction is extremely acid or very strongly acid throughout.

The A1 horizon is black (10YR 2/1) to dark brown (7.5YR 4/2). The A2 horizon is pinkish gray (7.5YR 7/2) to gray (10YR 5/1). The Bir horizon is dominantly dark brown (7.5YR 3/2) to brown (7.5YR 5/4). It is either sand or loamy sand. The B2 horizon is dominantly light yellowish brown (2.5Y 6/4) to yellowish red (5YR 5/6), and it typically is redder as depth increases. It is generally loamy sand or sand, but it is sandy loam in places. The C horizon is similar to the B2 horizon in color and texture.

The Leetonia variant soils are deeper over bedrock and contain fewer coarse fragments than do Leetonia soils.

The Leetonia variant soils are associated with the deep, well drained Morrison and Hazleton soils and the deep somewhat excessively drained Wyoming soils. They have more sand in the B horizon than Morrison soils and contain fewer coarse fragments than Hazleton and Wyoming soils.

LvB—Leetonia sand, variant, 3 to 8 percent slopes. This gently sloping soil is mainly in convex areas on uplands. Areas generally range from 5 to 25 acres in size. Runoff is very slow to slow, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level or sloping Leetonia variant soils. Small areas of Morrison and Hazleton soils are also included.

Nearly all of the acreage is in woodland. Because of the very low available water capacity and sandy texture, productivity of most crops is limited. Some areas that are near urban areas are being used for housing developments.

Most limitations are caused by the sandy texture, rapid permeability, and droughtiness. Capability subclass IVs.

LvC—Leetonia sand, variant, 8 to 15 percent slopes. The sloping soil is mainly in convex areas on uplands. Areas generally range from 5 to 30 acres in size. Runoff is slow to medium, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping or moderately steep Leetonia variant soils. Small areas of Morrison and Hazleton soils are also included.

Nearly all of the acreage is in woodland. Because of the very low available water capacity and slope, this soil is better suited to wildlife habitat and esthetic uses than to most other uses. Some areas that are near urban areas are being used for housing development.

Most limitations are caused by sandy texture, rapid permeability, droughtiness, and slope. Capability subclass VIe.

Lindside Series

The Lindside series consists of deep, moderately well drained soils that formed in alluvium washed from uplands underlain by limestone and shale. These nearly level soils are on flood plains.

In a representative profile in cropland, the surface layer is dark grayish brown silt loam about 11 inches thick. The subsoil is yellowish brown and brown silt loam and silty clay loam 30 inches thick. It has light brownish gray, grayish brown, and strong brown mottles below a depth of 21 inches. The substratum to a depth of 60 inches is yellowish brown loam that has grayish brown and strong brown mottles.

Permeability is moderate, and available water capacity is high. These soils are occasionally flooded, and a seasonal high water table is at a depth of 1½ to 3 feet during wet periods. Most limitations are related to flooding and the seasonal high water table.

Most of the acreage of these soils is in cropland or pasture. A few areas are in woodland.

Representative profile of Lindside silt loam in an area of Lindside soils in cropland, 900 feet south of the junction of L.R. 14023 and T–407, 200 feet north of woodland, 850 feet east of T–407 along field trail on south side of Sinking Creek, 2.8 miles southwest of Spring Mills in Potter Township:

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B1—11 to 21 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

B21—21 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B22—26 to 41 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) mottles and common fine prominent strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to weak fine subangular blocky; friable, slightly sticky and slightly plastic; medium acid; clear wavy boundary.

IIC—41 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; massive; friable,

slightly sticky and slightly plastic; 10 percent coarse fragments; medium acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 6 feet. Coarse fragments are commonly not present, but in places they range to as much as 5 percent in the upper 40 inches. If these soils are not limed, reaction is slightly acid or medium acid throughout.

The Ap horizon is dark grayish brown (10YR 4/2) to brown (7.5YR 5/2). It is generally silt loam or loam. The B horizon is dark brown (7.5YR 4/2) to yellowish brown (10YR 5/6) and is mottled in the lower part. It is dominantly silt loam or silty clay loam. The C horizon is mainly dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4) and is mottled. It is silty clay loam to loam or fine sandy loam, and it is weakly stratified and gravelly below a depth of 40 inches in places.

Lindside soils are closely associated on flood plains with the deep, well drained Chagrin soils; the deep, poorly drained Melvin soils; and the deep, very poorly drained Dunning soils. They are near the deep, moderately well drained Clarksburg soils; the deep, well drained Edom, Hagerstown, Millheim, and Hublersburg soils; and the shallow, well drained Opequon soils on uplands.

Lx—Lindside soils. These nearly level soils are in flat areas on flood plains in limestone valleys. Areas generally range from 2 to 20 acres in size. Runoff is slow, and the erosion hazard is slight unless flooding occurs. The surface layer is dominantly silt loam or loam.

Included with these soils in mapping are a few small areas of gently sloping and frequently flooded Lindside soils. Also included are a few small areas of soils that are similar to Lindside soils but that are mottled between depths of 12 and 18 inches, of soils that have a loam or sandy loam subsoil and are stratified within a depth of 40 inches, and of soils of local alluvium on uplands. Small areas of Chagrin and Melvin soils are also included.

Most of the acreage is in cropland or pasture. The suitability for crops is excellent. Alfalfa and winter grain are affected by frost heaving. Using cover crops and managing crop residue helps protect these soils from erosion during times of flooding. Areas that have been scoured should be used for permanent hay or pasture.

Most limitations are caused by occasional flooding and the seasonal high water table. Capability subclass IIw.

Markes Series

The Markes series consists of moderately deep, poorly drained soils that formed in shale and siltstone residuum. These nearly level to sloping soils are in concave areas on uplands.

In a representative profile in a cultivated area, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is light brownish gray and gray shaly and very shaly silt loam 13 inches thick. It has light gray, light brownish gray, and strong brown mottles. The substratum is olive gray very shaly silt loam 7 inches thick and has gray and strong brown mottles. Olive gray partly weathered bedrock is at a depth of 29 inches.

Permeability is slow, and available water capacity is low to moderate. A high water table is within a depth of one-half foot during wet periods, and occasional ponding occurs in some areas. Most limitations are related to the high water table, slow permeability, moderate depth to rippable bedrock, the many coarse fragments in the subsoil, and occasional ponding.

Most of the acreage of these soils is used for pasture or is idle.

Representative profile of Markes silt loam, 2 to 10 percent slopes, in an idle field, 300 feet north of L.R. 14052, 700 feet west of its junction with T–441, 0.75 mile northeast of Curtin in Boggs Township:

Ap—0 to 9 inches; dark grayish brown (2.5Y 4/2) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; neutral; abrupt smooth boundary.

B21tg—9 to 13 inches; light brownish gray (2.5Y 6/2) shaly silt loam; many medium prominent strong brown (7.5YR 5/6) and light gray (N 7/0) mottles; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 35 percent coarse fragments; few faint clay and silt coatings on ped faces; strongly acid; clear wavy boundary.

B22tg—13 to 22 inches; gray (N 6/0) very shaly silt loam; many coarse prominent strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) mottles; moderate fine subangular blocky structure; firm, slightly sticky and slightly plastic; 80 percent coarse fragments; common faint clay and silt coatings on ped faces and on shale fragments; very strongly acid; clear wavy boundary.

C—22 to 29 inches; olive gray (5Y 5/2) very shaly silt loam; many coarse prominent strong brown (7.5YR 5/6) and gray (N 5/0) mottles; massive; firm, slightly sticky and slightly plastic; 90 percent coarse fragments; common moderate silt coatings and many prominent black coatings on shale fragments; medium acid; clear wavy boundary.

R—29 inches; olive gray (5Y 4/2) partly weathered shale.

The solum ranges from 18 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments ranges from 5 to 25 percent in the A horizon, 35 to 80 percent in the B horizon, and 60 to 90 percent in the C horizon. If these soils are not limed, reaction ranges from very strongly acid to medium acid in the solum and from strongly acid to medium acid in the C horizon.

The Ap horizon, if present, is very dark grayish brown (10YR 3/2) to olive (5Y 4/3). The B horizon is dark gray (N 4/0) to light brownish gray (10YR 6/2) or light olive gray (5Y 6/2) and is mottled. The fine earth fraction is loam to silty clay loam. The C horizon is similar to the B horizon in color and texture.

Markes soils are associated with the deep, moderately well drained Wharton soils; the moderately deep, well drained Berks soils; and the shallow, well drained Weikert soils. Markes soils are similar in drainage to Purdy, Armagh, Brinkerton, and Andover soils, but they contain more coarse fragments and are not so deep to bedrock as those soils.

MaB—Markes silt loam, 2 to 10 percent slopes. This nearly level to sloping soil is in concave areas on uplands. Areas generally range from 3 to 80 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of Markes soils in which the surface layer is more than 25 percent coarse fragments. Also included were a few small areas of wetter soils, of soils that contain less than 35 percent coarse fragments throughout, of soils that do not have mottles above a depth of 6 inches, and of soils that are similar to Markes soils but that have bedrock at a depth of more than 40 inches. Small areas of Armagh, Brinkerton, Cavode, Wharton, and Berks soils are also included.

Most of the acreage is used for pasture or is idle. This soil is suited to pasture and crops. The high water table delays use of this soil in spring. Drainage ditches, diversion terraces, and tile drains help to lower the water table and allow use earlier in spring.

Most limitations are caused by the high water table, slow permeability, the high percentage of coarse fragments in the subsoil, and the moderate depth to rippable bedrock. Capability subclass IVw.

Meckesville Series

The Meckesville series consists of deep, well drained soils that formed in siltstone, shale, and sandstone colluvium. These nearly level to moderately steep soils are on concave mid and lower foot slopes of mountains.

In a representative profile the surface layer is reddish brown silt loam about 7 inches thick. The upper 21 inches of the subsoil is reddish brown and weak red silt loam; the next 26 inches is a fragipan of firm and brittle, weak red channery silt loam; and the lower 13 inches is weak red channery silt loam. The substratum is weak red very channery silt loam to a depth of 80 inches.

Permeability is moderately slow, and available water capacity is moderate. A fragipan is in the subsoil. Most limitations are related to moderately slow permeability, slope, and surface stones in some very stony areas.

About half of the acreage of these soils is in woodland, and most of the rest is used for crops.

Representative profile of Meckesville silt loam, 8 to 15 percent slopes, in a hayfield, along L.R. 14008, 2.2 miles northwest of Julian in Huston Township:

Ap—0 to 7 inches; reddish brown (5YR 4/3) silt loam; moderate coarse granular structure; very friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid; abrupt wavy boundary.

B21t—7 to 14 inches; reddish brown (2.5YR 4/4) heavy silt loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—14 to 19 inches; reddish brown (2.5YR 4/4) heavy silt loam; moderate medium and coarse subangular blocky structure; friable, slightly sticky and plastic; 10 percent coarse fragments; few faint clay films in pores; very strongly acid; clear wavy boundary.

B23t—19 to 28 inches; weak red (10R 4/3) heavy silt loam; light reddish brown (5YR 6/3) prism faces; moderate very coarse prismatic structure parting to weak medium angular blocky; firm, slightly sticky and plastic; 10 percent coarse fragments; many faint clay films in pores; few oxide coatings; very strongly acid; gradual wavy boundary.

Bx1—28 to 47 inches; weak red (10R 4/3) channery silt loam; light reddish brown (5YR 6/3) prism faces; moderate very coarse prismatic structure parting to weak medium platy; firm and brittle, slightly sticky and plastic; 20 percent coarse fragments; many moderate clay films in pores; few oxide coatings; very strongly acid; clear wavy boundary.

Bx2—47 to 54 inches; weak red (10R 4/4) channery silt loam; light reddish brown (5YR 6/3) prism faces; weak very coarse prismatic structure parting to weak medium platy; firm and brittle, slightly sticky and slightly plastic; 35 percent coarse fragments; many moderate clay films in pores and on coarse fragments; few oxide coatings; extremely acid; clear wavy boundary.

B3—54 to 67 inches; weak red (10R 4/4) channery silt loam; weak medium and coarse subangular blocky structure; firm, slightly sticky and slightly plastic; 30 percent coarse fragments; many moderate clay films in pores and on coarse fragments; few oxide coatings; very strongly acid; gradual wavy boundary.

C—67 to 80 inches; weak red (10R 4/3) very channery silt loam; massive; friable, slightly sticky and slightly plastic; 60 percent coarse fragments; many moderate clay films in pores and on coarse fragments; very strongly acid.

The solum is 50 to 75 inches thick. Depth to bedrock is 6 feet or more. Depth to the fragipan is 25 to 36 inches. Content of coarse fragments, mainly red sandstone or shale, ranges from 5 to 20 percent in the upper part of the solum, 10 to 40 percent in the lower part of the solum, and 20 to 80 percent in the C horizon. If these soils are not limed, reaction is extremely acid or very strongly acid throughout.

The Ap horizon, if present, is generally dark reddish brown (5YR 3/2) or reddish brown (5YR 4/4). The Bt horizon is dark reddish brown (5YR 3/3) to red (10YR 5/6). It is mainly heavy silt loam or heavy loam. The Bx horizon is mainly weak red (10R 4/4

or 10R 4/3). It is dominantly heavy loam, silt loam, or light clay loam. The C horizon is similar to the Bx horizon in color and texture.

Meckesville soils occupy the same colluvial landscape as the deep, moderately well drained Albrights soils and the deep, poorly drained Brinkerton soils. They are near the deep, well drained Leck Kill and Ungers soils and the moderately deep, well drained Calvin soils. Meckesville soils have a fragipan, and Leck Kill, Ungers, and Calvin soils do not. Meckesville soils are similar to the Laidig soils in drainage and colluvial landscape position, but they are redder.

MeB—Meckesville silt loam, 3 to 8 percent slopes. This gently sloping soil is on foot slopes on uplands. Areas generally range from 3 to 30 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level or sloping Meckesville soils and of soils in which the surface layer is more than 10 percent coarse fragments. Small areas of Leck Kill, Ungers, and Albrights soils are also included.

Most of the acreage is used for crops. This soil is very well suited to crops. Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by the moderately slow permeability of the fragipan. Capability subclass IIe.

MeC—Meckesville silt loam, 8 to 15 percent slopes. This sloping soil is on sides of ridges on uplands. Areas generally range from 3 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping or moderately steep Meckesville soils and of soils in which the surface layer is more than 10 percent coarse fragments. Small areas of Leck Kill, Ungers, and Albrights soils are also included.

Most of the acreage is used for pasture and crops. This soil is well suited to pasture and crops. Because of slope and erodibility, stripcropping and using diversion terraces and waterways are necessary to control erosion and retain soil nutrients in cultivated areas.

Most limitations are caused by slope, erodibility, and moderately slow permeability of the fragipan. Capability subclass IIIe.

MkB—Meckesville very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is on ridgetops on uplands. Areas generally range from 5 to 100 acres in size. Runoff is medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of nearly level, sloping, or nonstony Meckesville soils. Small areas of Albrights, Leck Kill, and Ungers soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by surface stoniness and moderately slow permeability of the fragipan. Capability subclass VIs.

MkD—Meckesville very stony silt loam, 8 to 25 percent slopes. This sloping to moderately steep soil is on side slopes on uplands. Areas generally range from 5 to 100 acres in size. Runoff is medium to rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of gently sloping, steep, or nonstony Meckesville soils. Small areas of Leck Kill, Ungers, and Albrights soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by slope, surface stoniness, and moderately slow permeability of the fragipan. Capability subclass VIs.

Melvin Series

The Melvin series consists of deep, poorly drained soils that formed in alluvium washed from uplands underlain by limestone and shale. These nearly level soils are on flood plains.

In a representative profile in pasture, the surface layer is very dark gray silt loam that has brown mottles and is about 3 inches thick. The subsoil is light brownish gray silty clay loam that has gray and brown mottles and is 29 inches thick. The substratum to a depth of 60 inches is dark gray and gray silty clay loam and loam that has brown, gray, and light olive brown mottles.

Permeability is moderate, and available water capacity is high. These soils are frequently flooded, and a high water table is within a depth of ½ foot during wet periods. Most limitations are related to the frequent flooding and high water table.

Most of the acreage of this soil is in pasture or woodland.

Representative profile of Melvin silt loam in pasture, 150 feet south of T–418, 300 feet east of its junction with L.R. 14023, 1.25 miles northeast of Tusseyville in Potter Township:

A1—0 to 3 inches; very dark gray (5Y 3/1) silt loam; few fine prominent brown (7.5YR 4/4) mottles; weak medium granular structure; friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B2g—3 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint gray (5Y 5/1) mottles and few fine prominent brown (7.5YR 4/4) mottles; weak fine and medium subangular blocky structure; friable, sticky and plastic; neutral; clear wavy boundary.

C1g—32 to 52 inches; dark gray (5Y 4/1) silty clay loam; common fine faint gray (10YR

5/1) mottles and common fine and prominent brown (7.5YR 4/4) mottles; massive; friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

C2g—52 to 60 inches; gray (5Y 5/1) loam; common fine prominent light olive brown (2.5Y 5/6) mottles; massive; friable, slightly sticky and slightly plastic; neutral.

The solum ranges from 18 to 40 inches in thickness. Depth to bedrock is more than 6 feet. Content of coarse fragments is less than 5 percent to a depth of 30 inches, but it is slightly greater below a depth of 30 inches in places. Reaction ranges from slightly acid to mildly alkaline throughout.

The A1 horizon is very dark gray (10YR 3/1) to very dark grayish brown (2.5Y 3/2). The B horizon is light gray (10YR 7/2) to dark gray (5Y 4/1, N 4/0) and is mottled. It is silt loam or silty clay loam. The C horizon is similar to the B horizon in color, but its texture below a depth of 40 inches varies greatly because of stratification.

Melvin soils are closely associated on flood plains with the deep, well drained Chagrin soils; the deep, moderately well drained Lindside soils; and the deep, very poorly drained Dunning soils. They are near the deep, moderately well drained Clarksburg soils; the deep, well drained Edom, Hagerstown, and Hublersburg soils; and the shallow, well drained Opequon soils on uplands.

Mm—Melvin silt loam. This nearly level soil is in flat areas on flood plains in limestone valleys. Areas generally range from 2 to 100 acres in size. Runoff is slow, and the erosion hazard is slight unless flooding occurs.

Included with this soil in mapping are a few small areas of gently sloping and occasionally flooded Melvin soils. Also included are a few small areas of soils that are similar to Melvin soils but that do not have mottles above a depth of 12 inches and of soils that have stratified sand and gravel above a depth of 40 inches. Small areas of Lindside, Dunning, and Chagrin soils are also included.

Most of the acreage is in pasture, cropland, or woodland. This soil is very well suited to crops if the high water table is lowered. A bedding system or drainage ditches help to lower the high water table and allow tillage earlier in spring.

Most limitations are caused by the frequent flooding by stream overflow or localized ponding and the high water table. Capability subclass IIIw.

Millheim Series

The Millheim series consists of deep, well drained soils that formed in calcareous, carbonaceous shale residuum. These nearly level to moderately steep soils are on uplands in limestone and shale valleys.

In a representative profile in cropland, the surface layer is dark grayish brown silt loam about 9 inches thick. The upper 8 inches of the subsoil is brown silty clay, and the lower 25 inches is very dark grayish brown and very dark brown silty clay. Very dark brown calcareous shale bedrock is at a depth of 42 inches.

Permeability is moderate, and available water capacity is moderate. Most limitations are related to the 3½ to 6 foot depth to rippable shale bedrock and to slope.

Most of the acreage of this soil is in cropland.

Representative profile of Millheim silt loam, 2 to 8 percent slopes, in cropland, 200 feet northeast of a black cherry tree on east side of L.R. 14043, 0.5 mile south of its junction with Pa–45 in Gregg Township (engineering samples BK–27591 and BK–27592):

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate very fine subangular blocky structure; friable, slightly sticky and plastic; slightly acid; abrupt smooth boundary.

B21t—9 to 17 inches; brown (7.5YR 4/4) silty clay; moderate fine and medium angular blocky structure; firm, sticky and plastic; few faint clay films on ped faces and in pores; strongly acid; clear wavy boundary.

B22t—17 to 34 inches; very dark grayish brown (10YR 3/2) silty clay; strong medium angular blocky structure; firm, sticky and plastic; common moderate clay films on ped faces and in pores; strongly acid; gradual wavy boundary.

B3t—34 to 42 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) silty clay; moderate medium angular blocky structure; friable, sticky and slightly plastic; 10 percent coarse fragments; common prominent clay films in root channels and common faint clay films in pores; medium acid.

R—42 inches; very dark brown calcareous shale bedrock.

The solum ranges from 20 to 50 inches in thickness. Depth to bedrock ranges from 3½ to 6 feet. Content of coarse shale or shaly carbonaceous limestone fragments ranges from 0 to 20 percent in the upper part of the solum and from 0 to 35 percent in the lower part. If these soils are not limed, reaction ranges from very strongly acid to medium acid in the upper part of the solum and from medium acid to neutral in the lower part.

The Ap horizon is brown (10YR 4/3) to dark brown (7.5YR 3/2). The B21t horizon is yellowish brown (10YR 5/4) to brown (7.5YR 4/4). The B22t and B3t horizons are dark grayish brown (10YR 4/2) to dark brown (7.5YR 3/2). The B horizon is silty clay loam, silty clay, or clay. Some areas have a C horizon that is similar to the lower part of the B horizon in color and texture, but it is 10 to 70 percent coarse fragments.

Millheim soils are associated with the deep, well drained Edom soils; the deep, moderately well drained Clarksburg soils; the moderately deep, well drained Berks soils; and the shallow, well drained Weikert and Opequon soils. They have a darker B horizon than Edom soils.

MnB—Millheim silt loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is on uplands. Areas generally range from 3 to 40 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of sloping Millheim soils. Also included are a few small areas of soils that are similar to Millheim soils but that are less than 40 inches deep over shale bedrock and of soils that have a less clayey subsoil and that contain more coarse fragments. Small areas of Edom, Berks, and Weikert soils are also included.

Nearly all of the acreage is used for crops. This soil is very well suited to crops. Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by the 3½ to 6 foot depth to rippable shale bedrock. Capability subclass IIe.

MnC—Millheim silt loam, 8 to 15 percent slopes. This sloping soil is on side slopes on uplands. Areas generally range from 3 to 40 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping or moderately steep Millheim soils. Also included are a few small areas of soils that are similar to Millheim soils but that are less than 40 inches deep over shale bedrock and of soils that contain more coarse fragments throughout and that have a less clayey subsoil. Small areas of Edom, Berks, and Weikert soils are also included.

Most of the acreage is used for crops. This soil is well suited to crops if intensive conservation practices are used. The use of stripcropping, diversion terraces, and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by the 3½ to 6 foot depth to rippable shale bedrock and slope. Capability subclass IIIe.

MnD—Millheim silt loam, 15 to 25 percent slopes. This moderately steep soil is on upper side slopes on shale uplands. Areas generally range from 2 to 20 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping Millheim soils. Also included are a few small areas of soils that are similar to Millheim soils but that are less than 40 inches deep over shale bedrock and of soils that contain more coarse fragments throughout and have a less clayey subsoil. Small areas of Berks, Edom, and Weikert soils are also included.

Most of the acreage is used for pasture, permanent hay, or crops, and this soil is suited to these uses. In cultivated areas, intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to help control erosion and to retain soil nutrients.

Most limitations are caused by slope, the 3½ to 6 foot depth to rippable shale bedrock, and the high erosion hazard in cultivated areas. Capability subclass IVe.

Monongahela Series

The Monongahela series consists of deep, moderately well drained soils that formed in old alluvium washed from uplands underlain by mainly sandstone and shale. These nearly level and gently sloping soils are on terraces above flood plains along the major streams.

In a representative profile in a cultivated area, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches. The upper 20 inches is yellowish brown silty clay loam, and the lower 31 inches is a fragipan of firm and brittle, yellowish brown gravelly clay loam that has light brownish gray and strong brown mottles.

Permeability is moderately slow, and available water capacity is moderate. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods. A fragipan is in the lower part of the subsoil. Most limitations are related to the seasonal high water table and moderately slow permeability.

Most of the acreage of these soils is in cropland or pasture.

Representative profile of Monongahela silt loam, 2 to 8 percent slopes, in cropland, 120 feet north of the railroad tracks and 350 feet east of the Curtin Mansion at Curtin in Boggs Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable, nonsticky and nonplastic; 5 percent coarse fragments; neutral; abrupt smooth boundary.

B21t—9 to 17 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; common faint clay films on ped faces and in pores; slightly acid; gradual wavy boundary.

B22t—17 to 29 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; many faint clay films on ped faces and in pores; slightly acid; clear wavy boundary.

Bx—29 to 60 inches; yellowish brown (10YR 5/4) gravelly clay loam; common fine and medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to weak thick platy and weak medium subangular blocky; firm, brittle, slightly sticky and slightly plastic; 15 percent coarse fragments; few faint clay films on ped faces and in pores; strongly acid.

The solum ranges from 40 to 72 inches in thickness. Depth to bedrock is more than 6 feet. Depth to the fragipan ranges from 18 to 30 inches. Content of rounded coarse fragments ranges to as much as 15 percent above the fragipan and to 25 percent in the fragipan. If these soils are not limed, reaction is strongly acid or very strongly acid throughout.

The Ap horizon is dark grayish brown (10YR 4/2) to brown (10YR 5/3). The B2t horizon is dark yellowish brown (10YR 4/4) to reddish yellow (7.5YR 6/8). It is silt loam to clay loam or sandy clay loam. The Bx horizon is brown (7.5YR 5/2) to olive yellow (2.5Y 6/6) and is mottled. It is silt loam to sandy clay loam.

Monongahela soils are closely associated on terraces with the deep, well drained Allegheny soils; the deep, somewhat poorly drained Tyler soils; and the deep,

poorly drained Purdy soils. They are near the deep, well drained Pope soils; the deep, moderately well drained Basher and Philo soils; the deep, poorly drained Atkins soils; and the deep, very poorly drained Dunning soils on flood plains.

MoB—Monongahela silt loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is in mainly concave areas on terraces along major streams. Areas generally range from 2 to 30 acres in size. Runoff is slow to medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of sloping Monongahela soils. Also included are a few small areas of soils that are similar to Monongahela soils but that are mottled between depths of 12 and 18 inches. Small areas of Allegheny, Tyler, and Purdy soils are also included.

Most of the acreage is used for crops or pasture. The soil is very well suited to crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Stripcropping and using diversion terraces help to control erosion, retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and the moderately slow permeability of the fragipan. Capability subclass IIe.

Morrison Series

The Morrison series consists of deep, well drained soils that formed in limy sandstone residuum. These nearly level to very steep soils are on sandy ridges on uplands in the dominantly limestone valleys.

In a representative profile in woodland, the surface layer is very dark brown loamy sand about 3 inches thick. The subsurface layer is strong brown sandy loam 11 inches thick. The subsoil is strong brown and yellowish red sandy loam and channery sandy clay loam 39 inches thick. The substratum is strong brown channery sandy loam that has streaks of yellowish red to a depth of 74 inches.

Permeability is moderately rapid and available water capacity is moderate. Most limitations are related to slope, erosion, and stones in some very stony areas.

Most of the acreage of these soils is in woodland. Some areas are in cropland.

Representative profile of Morrison sandy loam, 15 to 25 percent slopes, in woodland on State gameland, 225 feet east of abandoned railroad, 0.1 mile north of its junction with T-307, 2 miles northeast of Gatesburg in Ferguson Township:

A1—0 to 3 inches; very dark brown (10YR 2/2) loamy sand; weak fine granular structure; very friable, nonsticky and nonplastic; white quartz grains visible; 10 percent coarse fragments; strongly acid; clear wavy boundary.

A2—3 to 14 inches; strong brown (7.5YR 5/6) sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; white quartz grains visible; 10 percent coarse fragments; extremely acid; gradual wavy boundary.

B21t—14 to 20 inches; strong brown (7.5YR 5/8) sandy loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; few faint clay films on ped faces and clay bridging; very strongly acid; gradual wavy boundary.

B22t—20 to 35 inches; strong brown (7.5YR 5/6) channery sandy clay loam; moderate fine and medium subangular blocky structure; firm; slightly sticky and plastic; 15 percent coarse fragments; common faint clay films on ped faces and in pores; common prominent black coatings; strongly acid; clear wavy boundary.

B23t—35 to 47 inches; yellowish red (5YR 5/6) channery sandy clay loam; strong fine and medium angular blocky structure; firm, sticky and plastic; 20 percent coarse fragments; common prominent clay films on ped faces and in pores; common prominent black coatings; strongly acid; clear wavy boundary.

B24t—47 to 53 inches; strong brown (7.5YR 5/6) channery sandy clay loam; strong fine and medium angular blocky and subangular blocky structure; firm, sticky and plastic; 30 percent coarse fragments; common prominent clay films on ped faces and in pores; common prominent black coatings; medium acid; clear wavy boundary.

C—53 to 74 inches; strong brown (7.5YR 5/6) channery sandy loam; yellowish red (5YR 5/6) streaks; massive; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; few faint clay films in pores; medium acid.

The solum ranges from 40 to 70 inches in thickness. Depth to bedrock is more than 6 feet. Content of sandstone, chert, or quartzite coarse fragments ranges from 5 to 20 percent in the upper part of the solum and to as much as 30 percent in the lower part of the solum and in the C horizon. If these soils are not limed, reaction ranges from extremely acid to strongly acid in the upper part of the solum and is strongly acid or medium acid in the lower part of the solum and in the C horizon.

In undisturbed areas, these soils have a thin, black (10YR 2/1) to dark brown (7.5YR 3/2) A1 horizon. The A2 horizon generally is brown (10YR 5/3) to strong brown (7.5YR 5/6). The B horizon generally is brown (7.5YR 4/4) to reddish yellow (5YR 6/8). It is sandy loam or channery sandy loam to clay loam or channery clay loam. The C horizon is yellowish red (5YR 4/6) to yellowish brown (10YR 5/8). It is channery sandy loam or channery loamy sand.

Morrison soils are associated with the deep, well drained Vanderlip, Hagerstown, Hublersburg, and Murrill soils and the deep, somewhat excessively drained Wyoming soils. They have less sand in the B horizon than Vanderlip soils and have more sand in the A horizon and less clay throughout than Hublersburg soils. They have less clay and are more acid than Hagerstown soils, are less acid in the lower part of the B horizon than Murrill soils, and contain fewer coarse fragments throughout than Wyoming soils.

MrB—Morrison sandy loam, 2 to 8 percent slopes. This nearly level to gently sloping soil is on ridgetops on uplands. Areas generally range from 5 to 200 acres in size. Runoff is slow to medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of sloping and very stony Morrison soils. Small areas of Vanderlip, Wyoming, Murrill, Hublersburg, and Hagerstown soils are also included.

Much of the acreage is in woodland, but some areas are used for crops or pasture. The suitability of this soil for cropland is excellent (fig. 12). Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

This soil has few limitations. Capability subclass IIe.

MrC—Morrison sandy loam, 8 to 15 percent slopes. This sloping soil is on upper sides of ridges. Areas generally range from 3 to 75 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Morrison soils. Small areas of Vanderlip, Murrill, Wyoming, and Hublersburg soils are also included.

Much of the acreage is in woodland. Some areas are used for crops or pasture. This soil is very well suited to crops if intensive conservation practices such as stripcropping, diversion terraces, and waterways are used to help to control erosion and retain soil nutrients.

Most limitations are caused bv slope and erosion. Capability subclass IIIe.

MrD—Morrison sandy loam, 15 to 25 percent slopes. This moderately steep soil is on sides of ridges. Areas generally range from 2 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is high in cultivated areas. This soil has the profile described as representative of the series.

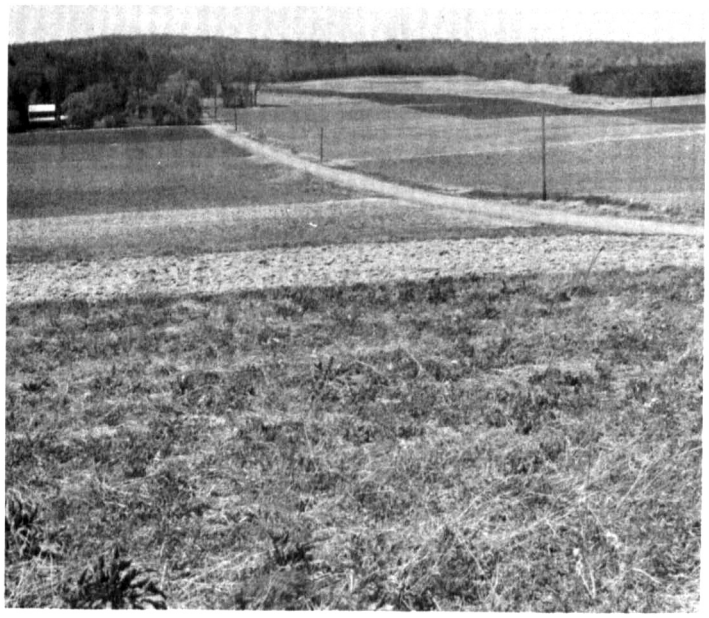

Figure 12.—**Morrison sandy loam, 2 to 8 percent slopes. The wooded ridge in the background is part of the Barrens area in the southwestern end of Nittany Valley.**

Included with this soil in mapping are a few small areas of sloping, steep, or very stony Morrison soils. Small areas of Vanderlip, Murrill, and Hublersburg soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. It is also well suited to other farming uses, but because of the moderately steep slopes and the high erosion hazard, very intensive conservation practices must be applied if the soil is cultivated to help control erosion and to retain soil nutrients.

Most limitations are caused by slope and erosion. Capability subclass IVe.

MsB—Morrison very stony sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is on ridgetops. Areas generally range from 5 to 100 acres in size. Runoff is slow to medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of sloping and nonstony Morrison soils. Small areas of Vanderlip, Wyoming, and Murrill soils are also included.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by the many surface stones. Capability subclass VIs.

MsD—Morrison very stony sandy loam, 8 to 25 percent slopes. This sloping to moderately steep soil is on sides of ridges. Areas generally range from 3 to 75 acres in size. Runoff is medium to rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of gently sloping, steep, or nonstony Morrison soils. Small areas of Vanderlip and Murrill soils are also included.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. If cleared of trees, it is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by the many surface stones and slope. Capability subclass VIs.

MTF—Morrison very stony sandy loam, steep. This soil is on sides of ridges. Slopes are 25 to 50 percent. This mapping unit is about 60 percent Morrison very stony sandy loam. Areas generally range from 3 to 50 acres in size. Runoff is rapid to very rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are moderately steep and nonstony Morrison soils and small areas of Vanderlip and Murrill soils. These inclusions make up 40 percent of the unit. Because this soil is steep, areas of this mapping unit were not investigated so thoroughly as areas of less sloping Morrison soils; therefore, areas of this mapping unit contain more inclusions than areas of less sloping Morrison soils.

Nearly all of the acreage is in woodland. This soil is well suited to woodland. Because of the steep and very steep slopes, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the steep and very steep slopes and the many stones on the surface. Capability subclass VIIs.

Murrill Series

The Murrill series consists of deep, well drained soils that formed in sandstone colluvium and underlying residuum weathered from limestone. These nearly level to moderately steep soils are mainly on concave, lower foot slopes along the edges of the limestone valleys.

In a representative profile in a cultivated area, the surface layer is dark brown channery silt loam about 11 inches thick. The upper 30 inches of the subsoil is brown and strong brown channery loam and channery clay loam. It has many black coatings below a depth of 22 inches. The lower 26 inches is yellowish red clay and has common black coatings.

Permeability is moderate, and available water capacity is moderate to high. Most limitations are related to possible sinkhole formation, slope, and stones in some very stony areas.

Most of the acreage of these soils is in cropland. Small areas are in woodland.

Representative profile of Murrill channery silt loam, 0 to 3 percent slopes, in cropland, 700 feet north of Pa–192, 3 miles northeast of Centre Hall in Gregg Township (engineering sample 71–20699) :

Ap—0 to 11 inches; dark brown (10YR 3/3) channery silt loam; weak medium subangular blocky structure; friable, nonsticky and slightly plastic; 15 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21t—11 to 22 inches; brown (7.5YR 5/4) channery loam; moderate medium subangular blocky structure; friable, slightly sticky and plastic; 30 percent coarse fragments; few faint clay films on ped faces; strongly acid; clear wavy boundary.

B22t—22 to 34 inches; strong brown (7.5YR 5/6) channery clay loam; moderate fine and medium subangular blocky structure; firm, slightly sticky and plastic; 30 percent coarse fragments; many moderate clay films on ped faces and in pores; many prominent black coatings on larger peds; very strongly acid; gradual wavy boundary.

B23t—34 to 41 inches; strong brown (7.5YR 5/6) channery clay loam; moderate fine and medium subangular blocky structure; firm, slightly sticky and plastic; 15 percent coarse fragments; many moderate clay films on ped faces and in pores; many prominent black coatings on larger peds; very strongly acid; clear wavy boundary.

IIB24t—41 to 52 inches; yellowish red (5YR 5/8) clay; moderate medium and coarse subangular blocky structure; firm, sticky and plastic; many moderate clay films on ped faces and in pores; common prominent black coatings on peds; very strongly acid; clear wavy boundary.

IIB3t—52 to 67 inches; yellowish red (5YR 4/8) clay; moderate medium platy structure; friable, sticky and plastic; common moderate clay films on peds; common prominent black coatings on peds; very strongly acid.

The thickness of the solum and depth to bedrock are generally more than 6 feet. The content of coarse fragments, mainly sandstone, ranges from 10 to 30 percent in the upper part of the solum. There generally are no coarse fragments in the lower part of the solum. If these soils are not limed, reaction is strongly acid or very strongly acid throughout.

The Ap horizon is very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/4). The upper part of the B horizon is dark reddish brown (5YR 3/4) to yellowish brown (10YR 5/6), and the lower part is reddish brown (2.5YR 4/4) to brownish yellow (10YR 6/8). The upper part of the B horizon is channery sandy clay loam to channery silt loam, and the lower part is clay loam to clay.

Murrill soils are associated with the deep, moderately well drained Buchanan soils; the deep, poorly drained Andover soils; the deep, well drained Laidig, Hagerstown, Hublersburg, and Morrison soils; and the shallow, well drained Opequon soils. They are less clayey in the upper part of the B horizon than Hagerstown and Hublersburg soils, lack the fragipan that is characteristic of Laidig soils, and are more acid than Morrison soils. They are near the deep, well drained Chagrin soils; the deep, moderately well drained Lindside soils; and the deep, poorly drained Melvin soils on flood plains. They are also near the Nolin soils, local alluvium.

MuA—Murrill channery silt loam, 0 to 3 percent slopes. This nearly level soil is on concave foot slopes in areas where the sandstone uplands join the limestone valleys. Areas generally range from 3 to 50 acres in size. Runoff is slow, and the erosion hazard is slight in uncultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping and very stony Murrill soils. Also included are a few small areas of soils that are similar to Murrill soils but that have limestone bedrock above a depth of 6 feet. Small areas of Nolin, Hagerstown, and Hublersburg soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping helps to control erosion and retain soil nutrients.

Most limitations are caused by possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability class I.

MuB—Murrill channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on concave upper foot slopes in areas where the sandstone uplands join the limestone valleys. Areas generally range from 5 to 100 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Murrill soils. Also included are a few small areas of soils that are similar to Murrill soils but that have limestone bedrock above a depth of 6 feet. Small areas of Nolin,

Hagerstown, Hublersburg, and Opequon soils are also included.

Most of the acreage is used for crops. This soil is excellently suited to crops. Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

Most limitations are caused by possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIe.

MuC—Murrill channery silt loam, 8 to 15 percent slopes. This sloping soil is on lower side slopes in areas where the sandstone uplands join the limestone valleys. Areas generally range from 2 to 40 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, or very stony Murrill soils. Also included are a few small areas of soils that are similar to Murrill soils but that have limestone bedrock above a depth of 6 feet. Small areas of Opequon, Hagerstown, and Hublersburg soils are also included.

Most of the acreage is used for crops or permanent hay. This soil is very well suited to crops if intensive conservation practices such as stripcropping, diversion terraces, and waterways are used to help control erosion and retain soil nutrients.

Most limitations are caused by possible sinkhole formation and slope. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IIIe.

MuD—Murrill channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on side slopes in areas where the sandstone uplands join the limestone valleys. Areas generally range from 2 to 20 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping and very stony Murrill soils. Also included are a few small areas of soils that are similar to Murrill soils but that have limestone bedrock above a depth of 6 feet. Small areas of Opequon, Hagerstown, and Hublersburg soils are also included.

Most of the acreage is used for permanent hay or pasture, and this soil is well suited to these uses. It is also well suited to crops. If the soil is cultivated, very intensive conservation practices such as stripcropping, diversion terraces, and waterways must be used to help control erosion and retain soil nutrients because of the moderately steep slopes and high erosion hazard.

Most limitations are caused by the moderately steep slopes and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass IVe.

MvB—Murrill very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is on concave foot slopes in areas where the sandstone uplands join the limestone valleys. Areas generally range from 2 to 40 acres in size. Runoff is slow to medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface layer has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of sloping, extremely stony, or nonstony Murrill soils. Also included are a few small areas of soils that are similar to Murrill soils but that have limestone bedrock within a depth of 6 feet. Small areas of Buchanan, Andover, and Laidig soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by the many surface stones and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass VIs.

MvD—Murrill very stony silt loam, 8 to 25 percent slopes. This sloping to moderately steep soil is on side slopes in areas where the uplands join the limestone valleys. Areas generally range from 2 to 30 acres in size. Runoff is medium to rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. This soil has a profile similar to the one described as representative of the series, but the surface has not been disturbed by cultivation.

Included with this soil in mapping are a few small areas of gently sloping, extremely stony, or nonstony Murrill soils. Also included are a few small areas of soils that are similar to Murrill soils but that have limestone bedrock within a depth of 6 feet. Small areas of Laidig and Buchanan soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. If cleared of trees, the soil is suited to unimproved pasture. The many stones on the surface make the use of modern farm machinery extremely difficult.

Most limitations are caused by slope, the many surface stones, and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal. Capability subclass VIs.

Nolin Series

The Nolin series consists of deep, well drained soils that formed in alluvium washed from uplands underlain by mostly limestone and shale. These nearly level and gently sloping soils are in areas of local alluvium on uplands.

In a representative profile the surface layer is dark brown silt loam about 9 inches thick. The upper 53 inches of the subsoil is dark yellowish brown and brown silt loam and silty clay loam, and the lower 16 inches is strong brown silty clay loam.

Permeability is moderate, and available water capacity is high. This soil is rarely flooded, but a seasonal high water table rises to a depth of 3 feet during wet periods. Most limitations are related to rare flooding.

Most of the acreage of these soils is in cropland.

Representative profile of Nolin silt loam, local alluvium, 0 to 5 percent slopes, in a housing development, 180 feet northeast of development entrance road, 240 feet northwest of Pa–64, 1.4 miles southwest of its junction with Pa–550 in Spring Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; clear smooth boundary.

B21—9 to 29 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; medium acid; gradual smooth boundary.

B22—29 to 49 inches; brown (7.5YR 4/4) silt loam; weak medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; medium acid; clear wavy boundary.

B23—49 to 62 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak coarse subangular blocky structure; friable, sticky and plastic; 10 percent coarse fragments; medium acid; gradual wavy boundary.

B24b—62 to 78 inches; strong brown (7.5YR 5/6) silty clay loam; weak coarse subangular blocky structure; friable, sticky and plastic; 10 percent coarse fragments; medium acid.

The solum is more than 40 inches thick. Depth to bedrock is more than 6 feet. Content of coarse fragments is generally less than 10 percent, but it ranges to as much as 15 percent. Reaction ranges from neutral to medium acid throughout.

The Ap horizon is very dark grayish brown (10YR 3/2) to brown (10YR 5/3). The B horizon is dark brown (10YR 4/3) to brown (7.5YR 5/4) silt loam or silty clay loam. In some areas, a buried B horizon is below a depth of 40 inches. It is yellowish brown (10YR 5/4) to yellowish red (5YR 5/6).

The Nolin soils are associated with the deep, well drained Hagerstown, Hublersburg, Edom, Millheim, and Murrill soils; the shallow, well drained Opequon soils; and the deep, moderately well drained Clarksburg soils. They are near the deep, poorly drained Melvin soils; the deep, very poorly drained Dunning soils; the deep, moderately well drained Lindside soils; and the deep, well drained Chagrin soils on flood plains. They contain less clay than Hagerstown, Hublersburg, Edom, and Millheim soils and contain fewer coarse fragments than Murrill soils. They contain more silt and less sand than Chagrin soils.

No—Nolin silt loam, local alluvium, 0 to 5 percent slopes. This nearly level to gently sloping soil is in flat areas of limestone valleys. Areas generally range from 2 to 15 acres in size. Runoff is generally slow, and the erosion hazard is slight to moderate in cultivated areas.

Included with this soil in mapping are a few small areas of soils that are similar to the Nolin soils but that have residual soil material within a depth of 40 inches and of soils that have slopes of more than 5 percent. Small areas of Lindside, Melvin, Hagerstown, Hublersburg, Edom, and Clarksburg soils are also included.

Most of the acreage is in cropland. This soil is excellently suited to crops. Using cover crops, managing crop residue, and stripcropping the gently sloping areas help to protect the soil from erosion and retain soil nutrients.

Most limitations are caused by rare flooding. Capability class I.

Opequon Series

The Opequon series consists of shallow, well drained soils that formed in limestone residuum. These nearly level to very steep soils are in convex areas on uplands in the dominantly limestone valleys.

In a representative profile the surface layer is dark brown silty clay loam about 9 inches thick. The subsoil is yellowish red silty clay 8 inches thick. Dark gray fractured limestone bedrock is at a depth of 17 inches.

Permeability is moderate, and available water capacity is low. Most limitations are related to slope, the shallow depth to limestone bedrock, the silty clay loam surface layer, the clayey subsoil, and possible sinkhole formation. Ground water pollution is a hazard if the soil is used for waste disposal.

Most of the acreage of these soils is used for crops, permanent hay, or pasture.

Representative profile of Opequon silty clay loam in an area of Opequon-Hagerstown complex, 3 to 8 percent slopes, in a housing development, 80 feet northeast of development entrance road, 250 feet northwest of Pa-64, 1.4 miles southwest of its junction with Pa-550 in Spring Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) silty clay loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; abrupt smooth boundary.

B2t—9 to 17 inches; yellowish red (5YR 4/6) silty clay; strong very fine and fine angular blocky structure; firm, sticky and plastic; 5 percent coarse fragments; many moderate clay films on ped faces and in pores; neutral; clear wavy boundary.

R—17 inches; dark gray (10YR 4/1) fractured limestone bedrock; reddish brown (5YR 4/4) silty clay coatings in cracks and fissures.

The thickness of the solum and depth to bedrock range from 12 to 20 inches. Content of coarse limestone fragments range to as much as 25 percent throughout the profile. Reaction ranges from medium acid to neutral throughout. In some areas, the lower part of the B horizon and the C horizon are mildly alkaline.

The Ap horizon is dark brown (10YR 3/3) to dark reddish gray (5YR 4/2). It has value of 5.5 or more when dry. The Ap horizon is silty clay loam or silt loam. The B horizon is red (2.5YR 4/6) to strong brown (7.5YR 5/8). It is heavy silty clay loam to clay. If present, the C horizon is generally darker than the B horizon. It is clay to silty clay loam or clay loam in places.

Opequon soils are associated on the landscape with the deep, well drained Hagerstown, Hublersburg, Edom, and Murrill soils; the deep, well drained Nolin soils, local alluvium; and the deep, moderately well drained Clarksburg soils. Opequon soils are near the deep, well drained Chagrin soils; the deep, moderately well drained Lindside soils; and the deep, poorly drained Melvin soils on flood plains.

OhB—Opequon-Hagerstown complex, 3 to 8 percent

slopes. This complex is on ridgetops on uplands. These gently sloping soils were mapped together because they are so intermingled that it was not practical to map them separately. This complex is about 50 percent Opequon soils, 30 percent Hagerstown soils, and 20 percent included soils. Areas generally range from 3 to 150 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. The surface layer is silty clay loam or silt loam. The Opequon and Hagerstown soils have the profiles described as representative of their respective series.

Included with these soils in mapping are a few small areas of nearly level or sloping Opequon and Hagerstown soils, small areas of Hublersburg and Edom soils, and a few areas of rock outcrop. Also included are areas of soils that are similar to Opequon and Hagerstown soils, but in which depth to bedrock is 20 to 40 inches; these areas make up as much as 15 percent of the unit.

Most of the acreage is used for permanent hay or for crops. Because the Opequon soil is shallow and has low available water capacity, this soil is better suited to permanent hay or pasture. The Hagerstown soil is excellently suited to most farm crops grown in the area. If the soils of this complex are cultivated, intensive conservation practices are necessary to control erosion and retain soil nutrients.

Most limitations are caused by the shallow depth to limestone bedrock of the Opequon soil and the clayey subsoil and possible sinkhole formation in Opequon and Hagerstown soils. Ground water pollution is a hazard if the soils are used for waste disposal. Capability subclass IIIe.

OhC—Opequon-Hagerstown complex, 8 to 15 percent slopes. This complex is on sides of ridges in limestone valleys. These sloping soils were mapped together because they are so intermingled that it was not practical to map them separately. The complex is about 55 percent Opequon soils, 25 percent Hagerstown soils, and about 20 percent included soils. Areas generally range from 2 to 50 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. The surface layer is silty clay loam or silt loam. The Opequon and Hagerstown soils have profiles similar to those described as representative of their respective series, but they generally contain 10 percent more coarse fragments throughout.

Included with these soils in mapping are a few small areas of gently sloping or moderately steep Opequon and Hagerstown soils, small areas of Hublersburg and Edom soils, and a few small areas of Rock outcrop. Also included are areas of soils that are similar to Opequon and Hagerstown soils but in which depth to bedrock is 20 to 40 inches; these areas make up as much as 15 percent of the unit.

Most of the acreage is used for permanent hay or for crops. Because the Opequon soil is shallow and has low available water capacity, this soil is better suited to permanent hay or pasture. The Hagerstown soil is excellently suited to most farm crops grown in the area. If the soils of this complex are cultivated, very intensive conservation practices are necessary to control erosion and retain soil nutrients.

Most limitations are caused by the shallow depth to limestone bedrock of the Opequon soil and the clayey subsoil, possible sinkhole formation, and slope of Opequon and Hagerstown soils. Ground water pollution is a hazard if the soils are used for waste disposal. Capability unit IVe.

OhD—Opequon-Hagerstown complex, 15 to 25 percent slopes. This complex is on sides of ridges in limestone valleys. These moderately steep soils were mapped together because they are so intermingled that it was not practical to map them separately. The complex is about 60 percent Opequon soils, 20 percent Hagerstown soils, and 20 percent included soils. Areas generally range from 2 to 20 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas. The surface layer is silty clay loam or silt loam. The Opequon and Hagerstown soils have profiles similar to those described as representative of their respective series, but they generally contain 10 to 15 percent more coarse fragments throughout.

Included with these soils in mapping are a few small areas of sloping or steep Opequon and Hagerstown soils, small areas of Hublersburg and Edom soils, and a few small areas of Rock outcrop. Also included are areas of soils that are similar to Opequon and Hagerstown soils, but in which depth to bedrock is 20 to 40 inches.

Most of the acreage is used for permanent hay or pasture. Because of the moderately steep slopes and the high hazard of erosion, these soils are better suited to permanent hay or pasture than to most other uses. Reestablishment of vegetative cover should be in contour strips to prevent excessive erosion and to retain soil nutrients.

Most limitations are caused by the shallow depth to limestone bedrock of the Opequon soils (fig. 13) and the clayey subsoil, possible sinkhole formation, and slope of Opequon and Hagerstown soils. Ground water pollution is a hazard if the soils are used for waste disposal. Capability subclass VIe.

ORF—Opequon-Hagerstown complex, steep. This complex is on steeper sides of ridges in the limestone valleys. Slopes are 25 to 90 percent. These soils were mapped together because they are so intermingled that it was not practical to map them separately. The complex is about 40 percent Opequon soils, 25 percent Hagerstown soils, and 35 percent included soils. Areas generally range from 2 to 30 acres in size. Runoff is rapid to very rapid. The surface layer is silt loam or silty clay loam. The Opequon and Hagerstown soils of this complex have profiles similar to those described as representative of their respective series, but the surface layer has not been disturbed by cultivation.

Included with these soils in mapping are small areas of soils in which depth to bedrock is 20 to 40 inches, many small areas of Rock outcrop, and small areas of Hublersburg and Edom soils. Because the soils of this complex are steep, areas of this mapping unit were not investigated so thoroughly as areas of less sloping Opequon and Hagerstown soils; therefore, areas of this mapping unit contain more included soils than areas of less sloping Opequon and Hagerstown soils.

Most of the acreage is in woodland. These soils are suited to woodland. Because these soils are steep and very steep, they are better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by the steep and very

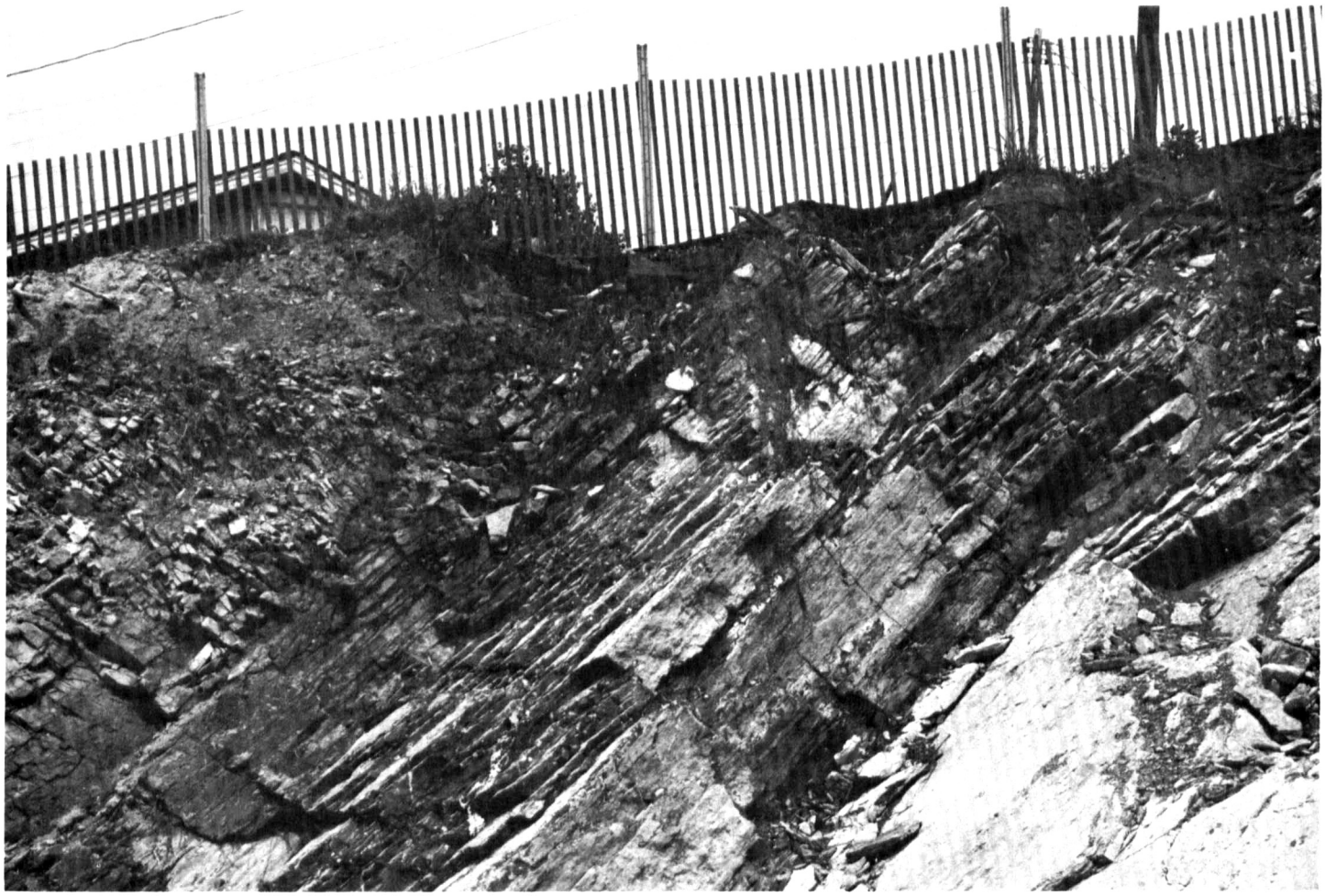

Figure 13.—An excavation in an area of Opequon-Hagerstown complex, 15 to 25 percent slopes. Opequon soil is at the right side of the excavation, and Hagerstown soil is at the left. Note the pitch of the bedding plane of the limestone bedrock.

steep slopes, the many limestone outcrops, and the variability of the depth to limestone bedrock. Ground water pollution is a hazard if the soils are used for waste disposal. Capability subclass VIIe.

OxB—Opequon-Rock outcrop complex, 0 to 8 percent slopes. This complex is on ridgetops in limestone valleys. These nearly level and gently sloping soils and Rock outcrop were mapped together because they are so intermingled that it was not practical to map them separately. The complex is about 50 to 80 percent Opequon soils and 10 to 25 percent Rock outcrop. Areas generally range from 2 to 50 acres in size. Runoff is slow to medium, and the erosion hazard is moderate in cultivated areas. The Opequon soils have a profile similar to the one described as representative of the Opequon series, but the surface layer is silt loam or silty clay loam and it generally has not been disturbed by cultivation. The Rock outcrop is limestone.

Included with these soils in mapping are a few small areas of sloping Opequon soils and Rock outcrop and small areas of Hagerstown, Nolin, and Hublersburg soils. Also included are areas of soils that are similar to Opequon soils but in which depth to bedrock is more than 20 inches; these areas make up as much as 25 percent of the unit.

Most of the acreage is used for pasture or woodland. This complex is suited to woodland. The many areas of Rock outcrop make the use of modern farm machinery extremely difficult.

Most limitations are caused by the shallow depth to limestone bedrock, limestone outcrop, and possible sinkhole formation. Ground water pollution is a hazard if the soils are used for waste disposal. Capability subclass VIs.

OxD—Opequon-Rock outcrop complex, 8 to 25 percent slopes. This complex is on sides of ridges in limestone valleys. These sloping and moderately steep soils and Rock outcrop were mapped together because they are so intermingled that it was not practical to map them separately. The complex is about 45 to 65 percent Opequon soils and 15 to 40 percent Rock outcrop. Areas generally range from 2 to 70 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas. The Opequon soils have a

profile similar to the one described as representative of the Opequon series, but the surface layer is silt loam or silty clay loam and it generally has not been disturbed by cultivation. The Rock outcrop is limestone.

Included with these soils in mapping are a few small areas of gently sloping and steep Opequon soils and Rock outcrop and small areas of Hagerstown and Hublersburg soils. Also included are areas of soils that are similar to Opequon soils, but in which depth to bedrock is more than 20 inches; these areas make up as much as 25 percent of the unit.

Most of the acreage is used for woodland or pasture. This complex is suited to woodland or pasture. The many areas of Rock outcrop (fig. 14) make the use of modern farm machinery extremely difficult.

Most limitations are caused by the shallow depth to limestone bedrock, limestone outcrops, slope, and possible sinkhole formation. Ground water pollution is a hazard if the soils are used for waste disposal. Capability subclass VIs.

Philo Series

The Philo series consists of deep, moderately well drained soils that formed in alluvium washed from uplands underlain by shale, siltstone, and sandstone. These nearly level soils are on flood plains.

In a representative profile the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is yellowish brown and strong brown loam 31 inches thick. It has light brownish gray and yellowish brown mottles below a depth of 20 inches. The substratum is yellowish brown gravelly loam that has pinkish gray mottles to a depth of 62 inches.

Permeability is moderate, and available water capacity is moderate to high. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods, and occasional flooding occurs. Most limitations are related to occasional flooding and the seasonal high water table.

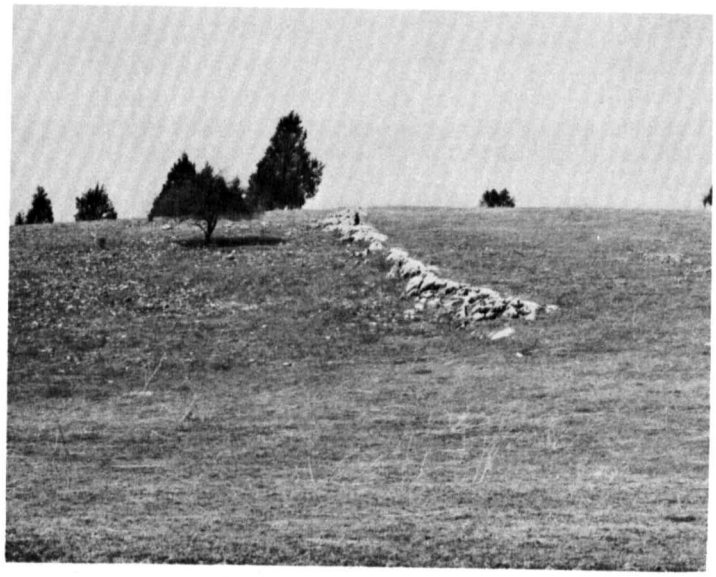

Figure 14.—An area of Opequon-Rock outcrop complex, 8 to 25 percent slopes. This complex is commonly used for pasture.

Most of the acreage of these soils is in woodland. Some is in cropland and pasture.

Representative profile of Philo loam in an idle field, 550 feet southeast of L.R. 14037 along One Mile Run, 0.6 mile northeast of Philipsburg State General Hospital in Rush Township:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; strongly acid; abrupt smooth boundary.

B1—5 to 13 inches; yellowish brown (10YR 5/6) loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; very strongly acid; clear smooth boundary.

B21—13 to 20 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; very strongly acid; clear wavy boundary.

B22—20 to 36 inches; strong brown (7.5YR 5/6) loam; common medium prominent light brownish gray (10YR 6/2) mottles and common medium faint yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak fine subangular blocky; friable, slightly sticky and slightly plastic; very strongly acid; diffuse smooth boundary.

IIC—36 to 62 inches; yellowish brown (10YR 5/4) gravelly loam; common medium prominent pinkish gray (5YR 6/2) mottles; weak medium platy structure; firm, slightly sticky and slightly plastic; 40 percent coarse fragments; few prominent black coatings on plate faces; very strongly acid.

The solum is 20 to 40 inches thick. It is silt loam to sandy loam. Depth to bedrock is generally more than 6 feet, and stratified sand and gravel is at a depth of 30 inches in places. Content of coarse fragments ranges from 0 to 20 percent in the solum and is generally more than 20 percent in the C horizon. If these soils are not limed, reaction ranges from very strongly acid to medium acid throughout.

The Ap horizon, if present, is very dark grayish brown (10YR 3/2) to brown (10YR 4/3). The B horizon is brown (7.5YR 4/2) to yellowish brown (10YR 5/6) or reddish yellow (7.5YR 6/6), and it is mottled in the lower part. The C horizon is light yellowish brown (10YR 6/4) to dark gray (N 4/0) or dark grayish brown (2.5Y 4/2) and is mottled.

Philo soils are associated on flood plains with the deep, well drained Pope soils; the deep, poorly drained Atkins soils; and the deep, very poorly drained Dunning soils. Philo soils are near the deep, poorly drained Brinkerton and Andover soils; the deep, moderately well drained Ernest and Buchanan soils; and the deep, well drained Hazleton soils on uplands. Philo soils are similar in drainage to Basher and Lindside soils on flood plains, but they are not so red throughout, and they are more acid and contain less clay in the B horizon than Lindside soils.

Ph—Philo loam. This nearly level soil is on flood

plains. Areas generally range from 2 to 50 acres in size. Runoff is slow, and the erosion hazard is slight unless flooding occurs. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of frequently flooded and very stony Philo soils and of soils that have mottles between depths of 12 and 18 inches. Small areas of Pope, Atkins, and Ernest soils are also included.

Most of the acreage is used for pasture or crops. This soil is excellently suited to pasture and crops. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table and occasional flooding delay tillage in spring. Tile drains or drainage ditches help lower the water table and allow tillage earlier in spring.

Most limitations are related to flooding caused by stream overflow or localized ponding and to the seasonal high water table. Capability subclass IIw.

Pk—Philo and Atkins very stony soils. These nearly level soils are in flat areas on flood plains in deep ravines of mountains. This mapping unit is about 40 percent Philo soil, 25 percent Atkins soil, and 35 percent included soils. Most areas, however, are all Philo soil, some are all Atkins soil, and others are both. Areas generally range from 3 to 20 acres in size. Runoff is slow. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter. The surface layer is dominantly silt loam or loam. The Philo soil has a profile similar to the one described as representative of the Philo series, but the surface layer has not been disturbed by cultivation. The Atkins soil has a profile similar to the one described as representative of the series.

Included with these soils in mapping are small areas of Rubble land and of Pope and Dunning soils. Also included are a few small areas of nonstony or extremely stony Philo and Atkins soils.

Most areas are in woodland. These soils are fairly well suited to excellently suited to woodland. Because of stoniness and flooding, the soils are better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness, the high water table, and flooding. Capability subclass VIs.

Pope Series

The Pope series consists of deep, well drained soils that formed in alluvium washed from uplands underlain by shale, siltstone, and sandstone. These nearly level soils are on flood plains.

In a representative profile in a cultivated area, the surface layer is brown loam about 10 inches thick. The subsoil is brown loam 28 inches thick. The substratum is dark yellowish brown gravelly sandy loam to a depth of 60 inches.

Permeability is moderately rapid, and available water capacity is moderate to high. These soils are occasionally flooded and are subject to a seasonal high water table at a depth of 3 feet during wet periods. Most limitations are related to occasional flooding.

About half of the acreage of these soils is in cropland and pasture, and the rest is in woodland.

Representative profile of Pope loam in an area of Pope soils in cropland, 125 feet northwest of Bald Eagle Creek, 1,800 feet south of farm buildings along U.S. 220, 0.6 mile west of Wingate in Union Township:

Ap—0 to 10 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid; abrupt smooth boundary.

B2—10 to 38 inches; brown (7.5YR 5/4) loam; weak medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 5 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—38 to 60 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; massive; very friable, nonsticky and nonplastic; 25 percent coarse fragments; very strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 6 feet. Content of coarse fragments, dominantly gravel, ranges to as much as 30 percent in the solum and to 40 percent in the C horizon. If these soils are not limed, reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon dominantly is grayish brown (10YR 5/2) to dark yellowish brown (10YR 4/4). It is dominantly loam or fine sandy loam, but it is silt loam in places. The B and C horizons are brown (10YR 4/3) to strong brown (7.5YR 5/6). The B horizon is sandy loam to silt loam and is gravelly in places. It has mottles below a depth of 24 inches in some profiles. The C horizon is gravelly loam or sandy clay loam to gravelly loamy sand.

Pope soils are associated on flood plains with the deep, moderately well drained Philo and Basher soils; the deep, poorly drained Atkins soils; and the deep, very poorly drained Dunning soils. They are near the deep, poorly drained Brinkerton and Andover soils; the deep, moderately well drained Ernest and Buchanan soils; and the deep, well drained Hazleton soils on uplands.

Po—Pope soils. These nearly level soils are in flat areas on flood plains. Areas generally range from 2 to 30 acres in size. Runoff is slow, and the erosion hazard is slight unless flooding occurs. The surface layer is dominantly loam or fine sandy loam.

Included with these soils in mapping are a few small areas of gently sloping, very stony, and frequently flooded Pope soils and of soils that are similar to Pope soils but that have stratified sand and gravel within a depth of 40 inches. Also included in the Bald Eagle Valley area are soils that are similar to Pope soils but that are redder throughout. Small areas of Philo, Atkins, and Basher soils are also included.

About half of the acreage is in cropland or pasture, and the rest is in woodland. The suitability of these soils for crops is excellent. Using cover crops and managing crop residue help to protect the soils from erosion during flooding. Areas that have been scoured should be kept in permanent hay or pasture.

Most limitations are caused by occasional flooding. Capability class I.

Purdy Series

The Purdy series consists of deep, poorly drained soils that formed in slack water sediment of clay and silt washed from uplands underlain by mainly shale and siltstone. These nearly level soils are on terraces above flood plains along the major streams.

In a representative profile the surface layer is very dark brown silt loam about 6 inches thick. The subsoil is grayish brown and gray silty clay loam and silty clay that has yellowish brown mottles and is 39 inches thick. The substratum to a depth of 62 inches is gray and brown silty clay that has yellowish brown and grayish brown mottles.

Permeability is slow, and available water capacity is high. A high water table is within a depth of ½ foot during wet periods. Most limitations are related to the high water table and slow permeability.

About half of the acreage of these soils is in woodland, and the rest is in pasture or cropland.

Representative profile of Purdy silt loam in woodland, 100 feet southeast of Penn-Central Railroad tracks, 700 feet northeast of its junction with a private trail, 350 feet east of its junction with U.S. 220 at the Blair County line in Taylor Township:

A1—0 to 6 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; very strongly acid; abrupt smooth boundary.

B21g—6 to 16 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; few faint clay films on ped faces and in pores; very strongly acid; gradual wavy boundary.

B22tg—16 to 45 inches; gray (5YR 5/1) silty clay; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; firm, sticky and plastic; many moderate clay films on ped faces and in pores; strongly acid; clear wavy boundary.

C—45 to 62 inches; gray (N 5/0) prism faces, brown (10YR 4/3) interiors of silty clay; common fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; few faint clay films in pores; strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 6 feet. The solum is generally free of coarse fragments, but in places the C horizon is as much as 15 percent pebbles or cobbles. If these soils are not limed, reaction ranges from strongly acid to extremely acid throughout.

In undisturbed areas, the A1 horizon is black (10YR 2/1) to dark olive gray (5Y 3/2). The B horizon is dark gray (N 4/0) to grayish brown (10YR 5/2) to olive gray (5Y 5/2) and is mottled. It is generally silty clay but it is clay, clay loam, or silty clay loam in places. The C horizon is greenish gray (5G 5/1) to gray (N 6/0), brown (10YR 4/3), or pale olive (5Y 6/3). It is similar to the B horizon in texture.

Purdy soils are closely associated on terraces with the deep, somewhat poorly drained Tyler soils; the deep, moderately well drained Monongahela soils; and the deep, well drained Allegheny soils. Purdy soils are near the deep, poorly drained Brinkerton and Andover soils and the deep, moderately well drained Ernest and Buchanan soils on colluvial uplands. They do not have the fragipan that is characteristic of Ernest and Buchanan soils.

Pu—Purdy silt loam. This nearly level soil is in concave areas on terraces along major streams. Areas generally range from 2 to 30 acres in size. Runoff is slow, and the erosion hazard is slight if the soil is cultivated.

Included with this soil in mapping are a few small areas of gently sloping Purdy soils and of soils that are similar to Purdy soils but that are wetter. Small areas of Tyler, Brinkerton, Andover, and Monongahela soils are also included.

About half of the acreage is in woodland. This soil is suited to woodland. Because of the high water table and slow permeability, the soil has only limited suitability for pasture or crops. In cultivated or pastured areas, a bedding system or drainage ditches help to lower the water table and allow use earlier in spring.

Most limitations are caused by the high water table and slow permeability. Capability subclass IVw.

Rayne Series

The Rayne series consists of deep, well drained soils that formed in shale, siltstone, and fine grained sandstone residuum. These nearly level to sloping soils are mainly in convex areas on uplands.

In a representative profile in woodland, 1 inch of organic material covers a surface layer of very dark grayish brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam 4 inches thick. The subsoil is yellowish brown shaly silty clay loam 34 inches thick. The substratum is yellowish brown very shaly silt loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is moderate to high. Most limitations are related to the 3½ to 6 foot depth to rippable shale bedrock.

Most of the acreage of these soils is in woodland.

Representative profile of Rayne silt loam, 2 to 10 percent slopes, in woodland, 50 feet south of T-405, 350 feet east of its junction with Kato road, 2.6 miles northeast of Clarence in Snow Shoe Township:

O2—1 inch to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid; abrupt smooth boundary.

A2—2 to 6 inches; yellowish brown (10YR 5/6) silt loam; weak fine granular structure; friable, slightly sticky and slightly plas-

tic; 10 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21t—6 to 20 inches; yellowish brown (10YR 5/4) shaly silty clay loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 20 percent coarse fragments; few faint clay films on ped faces and in pores; very strongly acid; gradual wavy boundary.

B22t—20 to 40 inches; yellowish brown (10YR 5/4) shaly silty clay loam; moderate medium subangular blocky structure; firm, sticky and slightly plastic; 30 percent coarse fragments; common faint and moderate clay films on ped faces and in pores; strongly acid; gradual wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) very shaly silt loam; massive; firm in place, slightly sticky and nonplastic; 70 percent coarse fragments; few faint clay films in pores and on coarse fragments; strongly acid.

The solum ranges from 36 to 50 inches in thickness. Depth to bedrock ranges from 3½ to 6 feet. Coarse fragments of shale, siltstone, and fine grained sandstone make up 5 to 30 percent of the upper part of the solum, 20 to 70 percent of the lower part of the solum, and as much as 90 percent of the C horizon. The average coarse fragment content between depths of 10 and 40 inches is less than 35 percent. If these soils are not limed, the reaction is strongly acid or very strongly acid throughout.

In undisturbed areas, the A1 horizon is thin and black (10YR 2/1) to very dark grayish brown (10YR 3/2). The A2 horizon generally is brown (10YR 4/3) to yellowish brown (10YR 5/6). The B horizon is brown (7.5YR 4/4) to yellowish brown (10YR 5/8). It ranges from loam to silty clay loam in texture and is shaly or channery in places. The C horizon is generally similar to the B horizon in color. It ranges from silty clay loam to sandy loam in texture, and it is generally very shaly or very channery.

Rayne soils are associated with the deep, well drained Clymer and Hazleton soils; the moderately deep, well drained Gilpin soils; the deep, moderately well drained Wharton soils; the deep, somewhat poorly drained Cavode soils; and the deep, poorly drained Armagh soils. Rayne soils contain fewer coarse fragments and have less sand than Hazleton soils. They have more silt in the B horizon than Clymer soils.

RaB—Rayne silt loam, 2 to 10 percent slopes. This nearly level to sloping soil is mainly in convex areas on ridgetops. Areas generally range from 5 to 30 acres in size. Runoff is slow to medium, and the erosion hazard is low to moderate in cultivated areas.

Included with this soil in mapping are a few small areas of very stony Rayne soils and of soils that are similar to Rayne soils but that contain more than 35 percent coarse fragments throughout. Small areas of Gilpin, Clymer, and Wharton soils are also included.

Most of the acreage is in woodland because areas of this soil are inaccessible. The soil is very well suited to crops. If used for crops, stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

Most limitations are related to the 3½ to 6 foot depth to rippable bedrock. Capability subclass IIe.

Rubble Land

Ru—Rubble land. These miscellaneous areas are nearly level to very steep. About 90 percent or more of the surface is covered by stones and boulders (fig. 15) of hard gray sandstone, conglomerate, or quartzite. Most areas are on steep talus slopes associated with the dominantly sandstone ridges of the Valley and Ridge province in the central and eastern parts of the county. Areas generally range in size from 5 to 100 acres.

Included in mapping are a few small areas of extremely stony Hazleton, Dekalb, and Laidig soils and a few small areas of rock escarpments.

Most of the acreage is used for wildlife habitat and esthetic uses. Rubble land is better suited to these uses than to most other uses. Many areas are bare because there is not enough soil between the stones and boulders to support vegetation. The stones and boulders are 1 foot to several feet in diameter. Where vegetation can survive, it consists mainly of a thin, scrubby stand of chestnut oak or mountain laurel.

Most limitations are related to the extreme stoniness or rockiness and the steep and very steep slopes. Capability subclass VIIIs.

Strip Mines

Sm—Strip mines, acid. These miscellaneous areas have been disturbed by excavating or stripping of soil and rock overburden to gain access to underlying beds of coal or fire clay (fig. 16). Strip mines consist of carbonaceous shale, sandstone, and shale fragments and soil material, the proportion of which vary greatly from place to place. They are on the Allegheny Plateau scattered throughout the northwestern part of the county. The areas are nearly level to very steep, irregular in shape, and about 10 to 400 acres in size. The less sloping areas are generally those that have been backfilled after the strip mine operation.

Permeability and depth of seasonal high water table are variable. Available water capacity is generally low to very low. Runoff is variable, and the hazard of erosion is generally high until a good plant cover can be established.

Included in mapping are a few small areas of Gilpin, Wharton, Cavode, Armagh, Rayne, Hazleton, and Clymer soils. A few small areas of Strip mines that are adjacent to drainageways and subject to flooding during periods of heavy rainfall and runoff.

Most of the acreage is used for woodland and wildlife habitat. Onsite investigation is necessary to determine the suitability of Strip mines for most uses. Most of the acreage has a sparse cover of small trees, shrubs, or weeds.

Most limitations are caused by the many coarse fragments throughout, the extremely acid material, and the extreme variability of its composition. Not assigned to a capability subclass.

Figure 15.—An area of Rubble land on Nittany Mountain in the central part of the county. The surface is a pavement of boulders and stones.

Tyler Series

The Tyler series consists of deep, somewhat poorly drained soils that formed in slack water sediment washed from uplands underlain by dominantly shale and siltstone. These nearly level soils are on terraces above flood plains along major streams.

In a representative profile in cropland, the surface layer is dark grayish brown silt loam about 11 inches thick. The upper 5 inches of the subsoil is brown heavy silt loam that has light brownish gray and strong brown mottles, and the lower 28 inches is a fragipan of firm and brittle, light yellowish brown silty clay loam that has light brownish gray and strong brown mottles. The substratum to a depth of 60 inches is yellowish brown loamy sand and mottled yellowish brown and grayish brown clay loam.

Permeability is slow, and available water capacity is moderate. A seasonal high water table is at a depth of ½ foot to 1½ feet during wet periods. A fragipan is in the lower part of the subsoil. Most limitations are caused by the seasonal high water table and slow permeability.

Most of the acreage of these soils is in cropland or pasture.

Representative profile of Tyler silt loam in cropland, 380 feet southeast of Curtin Methodist Church along L.R. 14010, 950 feet south of Curtin Mansion at Curtin in Boggs Township:

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; slightly acid; clear smooth boundary.

B2t—11 to 16 inches; brown (10YR 5/3) heavy silt loam; few fine faint light brownish gray (2.5Y 6/2) mottles and common fine distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; few faint clay films on ped faces and in pores; slightly acid; clear smooth boundary.

Bx—16 to 44 inches; light yellowish brown (2.5Y 6/4) silty clay loam; light gray (10YR 6/1) prism faces and light brownish gray (2.5Y 6/2) ped faces; common fine and medium distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; firm, brittle, slightly sticky and slightly plastic; common faint clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

IIC1—44 to 49 inches; yellowish brown (10YR 5/6) loamy sand; many medium prominent grayish brown (2.5Y 5/2) mottles; massive; very friable, nonsticky and nonplastic; very strongly acid; clear wavy boundary.

IIC2—49 to 60 inches; mottled yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) clay loam; massive; firm, sticky and plastic; 5 percent coarse fragments; very strongly acid.

The solum ranges from 40 to 55 inches in thickness. Depth to bedrock is more than 6 feet. Depth to the fragipan is 15 to 24 inches. The solum has only a few coarse fragments. If these soils are not limed, reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon is dark gray (10YR 4/1) to olive (5Y 5/3). The upper part of the B horizon is grayish brown (10YR 5/2) to olive yellow (2.5Y 6/6). The Bx horizon is brown (10YR 5/3) to olive yellow (5Y 6/6). The B horizon is mottled, and most ped and prism faces have chroma of 2 or less. The upper part of the B horizon is heavy silt loam or silty clay loam. The Bx horizon ranges from silty clay loam to light clay

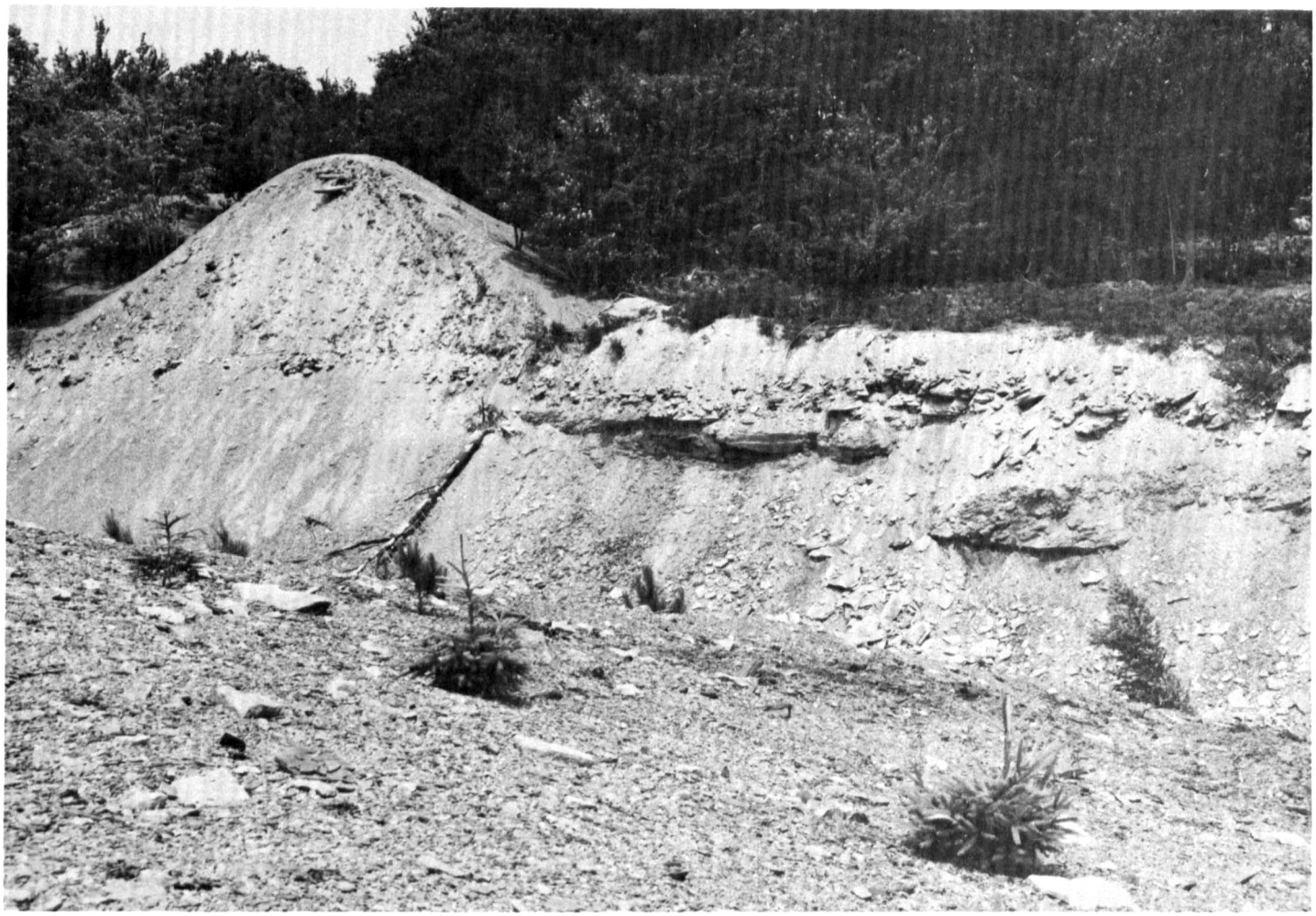

Figure 16.—**Strip mine near Philipsburg.**

loam. The IIC horizon is generally similar to the Bx horizon in color. It is generally stratified silt loam, loam, and silty clay loam, and occasional strata of loamy sand to silty clay are in some places.

Tyler soils are closely associated on terraces with the deep, well drained Allegheny soils; the deep, moderately well drained Monongahela soils; and the deep, poorly drained Purdy soils. Tyler soils are near the deep, poorly drained Brinkerton and Andover soils and the deep, moderately well drained Ernest and Buchanan soils on colluvial uplands.

Ty—Tyler silt loam. This nearly level soil is in concave areas on terraces along major streams. Areas generally range from 2 to 30 acres in size. Runoff is slow, and the erosion hazard is slight in uncultivated areas.

Included with this soil in mapping are a few small areas of gently sloping Tyler soils and small areas of Purdy, Monongahela, Brinkerton, and Andover soils. Also included are areas of soils that are similar to Tyler soils but that do not have a fragipan.

Most of the acreage is in cropland or pasture. This soil is well suited to crops or pasture. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays tillage in spring. Diversion terraces or open ditches help to lower the seasonal high water table and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and the slow permeability. Capability subclass IIIw.

Ungers Series

The Ungers series consists of deep, well drained soils that formed in sandstone and siltstone residuum. These nearly level to moderately steep soils are in high areas in the mountains.

In a representative profile in woodland, 2 inches of organic material covers a surface layer of very dark brown channery loam about 1 inch thick. The subsurface layer is dark reddish brown channery loam 5 inches thick. The subsoil is reddish brown and dusky red channery loam, sandy clay loam, and channery sandy clay loam 25 inches thick. The substratum is dark reddish brown very channery sandy loam to a depth of 61 inches.

Permeability is moderate, and available water ca-

pacity is moderate. Most limitations are related to slope and to surface stones in some very stony areas.

Most of the acreage of these soils is in woodland. Some small areas are used for crops.

Representative profile of Ungers channery loam, 3 to 8 percent slopes, in woodland, along T–300, 1.5 miles northeast of its junction with Pa–350 in Taylor Township:

O1—2 inches to 1 inch; undecomposed hardwood leaf litter.

O2—1 inch to 0; black (5YR 2/1) mostly decomposed organic material.

A1—0 to 1 inch; very dark brown (10YR 2/2) channery loam; weak very fine granular structure; very friable, nonsticky and nonplastic; 15 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—1 inch to 6 inches; dark reddish brown (5YR 3/3) channery loam; weak medium platy structure; very friable, slightly sticky and slightly plastic; 15 percent coarse fragments; very strongly acid; clear smooth boundary.

B1—6 to 10 inches; reddish brown (2.5YR 4/4) channery loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21t—10 to 20 inches; reddish brown (2.5YR 4/4) sandy clay loam; weak medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; 10 percent coarse fragments; common faint clay films in pores and on ped faces; strongly acid; gradual wavy boundary.

B22t—20 to 25 inches; reddish brown (2.5YR 4/4) channery sandy clay loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; common faint clay films in pores and on ped faces; strongly acid; gradual wavy boundary.

B23t—25 to 31 inches; dusky red (10YR 3/4) channery sandy clay loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; common moderate clay films in pores and on ped faces; strongly acid; gradual wavy boundary.

C1—31 to 42 inches; dark reddish brown (2.5YR 3/4) very channery sandy loam; massive; friable, slightly sticky and nonplastic; 50 percent coarse fragments; very strongly acid; gradual wavy boundary.

C2—42 to 61 inches; dark reddish brown (2.5YR 3/4) very channery sandy loam; massive; friable, nonsticky and nonplastic; 60 percent coarse fragments; very strongly acid.

The solum is 30 to 45 inches thick. Depth to bedrock is 3½ to 6½ feet or more. Content of coarse fragments, mainly red sandstone, ranges from 5 to 30 percent in the upper part of the solum, from 5 to 40 percent in the lower part of the solum, and from 40 to 90 percent in the C horizon. If these soils are not limed, reaction is strongly acid to extremely acid throughout.

In undisturbed areas, the A1 horizon is thin and is black (10YR 2/1) or very dark brown (10YR 2/2). The B horizon is reddish brown (5YR 5/4) to dusky red (10YR 3/3). It is loam, clay loam, or sandy clay loam and is channery. The C horizon is similar to the B horizon in color. It is channery or very channery loam or sandy loam.

Ungers soils are associated with the deep, well drained Meckesville and Leck Kill soils; the deep, moderately well drained Albrights soils; and the deep, poorly drained Brinkerton soils. They contain more sand than Leck Kill soils and do not have the fragipan that is characteristic of Meckesville soils. Ungers soils are near the deep, well drained Clymer and Hazleton soils, but they are redder than those soils.

UmB—Ungers channery loam, 3 to 8 percent slopes. This gently sloping soil is in convex areas on mountaintops. Areas generally range from 5 to 40 acres in size. Runoff is medium, and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level, sloping, nonchannery, or very stony Ungers soils. Also included are a few small areas of Ungers soils that have a surface layer of silt loam or sandy loam. Small areas of Meckesville, Clymer, Leck Kill, and Albrights soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. It has excellent suitability for crops. Stripcropping and using diversion terraces and waterways help to control erosion and retain soil nutrients.

This soil has few limitations. Capability subclass IIe.

UmC—Ungers channery loam, 8 to 15 percent slopes. This sloping soil is in convex areas on mountaintops. Areas generally range from 5 to 50 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, nonchannery, or very stony Ungers soils. Also included are a few small areas of Ungers soils that have a surface layer of silt loam or sandy loam. Small areas of Meckesville, Clymer, Leck Kill, and Albrights soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. It is very well suited to crops, but because of slope and the moderate to high erosion hazard, intensive conservation practices such as stripcropping, diversion terraces, and waterways are necessary to control erosion and retain soil nutrients.

Most limitations are caused by slope. Capability subclass IIIe.

UmD—Ungers channery loam, 15 to 25 percent slopes. This moderately steep soil is in convex areas on upper side slopes of mountains. Areas generally range from 3 to 30 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of soils that have a sandy loam surface layer and a few small areas of sloping, steep, or very stony

Ungers soils. Also included are a few small areas of soils that are similar to Ungers soils but that contain less clay in the subsoil and that have more than 35 percent coarse fragments throughout. Small areas of Clymer, Hazleton, Meckesville, and Leck Kill soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. If it is cultivated, very intensive conservation practices such as stripcropping, diversion terraces, and waterways must be applied to avoid excessive erosion and to retain soil nutrients.

Most limitations are caused by slope. Capability subclass IVe.

UnB—Ungers very stony loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in convex areas on mountaintops. Areas generally range from 5 to 80 acres in size. Runoff is slow to medium. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of sloping, nonstony, or extremely stony Ungers soils and a few small areas that have a surface layer of silt loam or sandy loam. Also included are a few small areas of soils that are similar to Ungers soils but that contain less clay in the subsoil and that have more than 35 percent coarse fragments throughout. Small areas of Clymer, Hazleton, Albrights, Meckesville, and Leck Kill soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. Because of the many surface stones and the inaccessibility of areas of the soil, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness. Capability subclass VIs.

UnD—Ungers very stony loam, 8 to 25 percent slopes. This sloping to moderately steep soil is in convex areas on upper side slopes of mountains. Areas generally range from 5 to 150 acres in size. Runoff is medium to rapid. From 3 to 15 percent of the surface is covered by stones 10 to 24 inches in diameter.

Included with this soil in mapping are a few small areas of gently sloping, steep, nonstony, or extremely stony Ungers soils and a few small areas that have a sandy loam surface layer. Also included are a few small areas of soils that are similar to Ungers soils but that contain less clay in the subsoil and that have more than 35 percent coarse fragments throughout. Small areas of Clymer, Hazleton, Laidig, Meckesville, and Leck Kill soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. Because of the many surface stones, the slope, and the inaccessibility of areas of the soil, the soil is better suited to woodland, wildlife habitat, and esthetic uses than to most other uses.

Most limitations are caused by surface stoniness and slope. Capability subclass VIs.

Urban Land

URB—Urban land-Hagerstown complex, gently sloping. Urban land and Hagerstown soils were mapped together because they are so intermingled that it was not practical to map them separately. This complex is on uplands and is underlain by limestone. It is about 40 percent Urban land, 30 percent Hagerstown soil, and 30 percent soils that are similar to Hagerstown soils but are less than 40 inches deep over limestone bedrock. Slopes are 0 to 8 percent.

Urban land consists of areas that are so altered or obscured by development of industrial, commercial, and housing sites that identification of the soil is not feasible. The original soil has been removed, covered, or mixed by earth moving or construction operations. Urban land is mainly impervious pavement and buildings from which the potential runoff is very rapid. Most of the acreage of Urban land is in the limestone valleys of Centre County. The Hagerstown soil has a surface layer of silt loam or silty clay loam.

Included with these soils in mapping in the western part of the county are areas associated with acid shale or sandstone material instead of limestone material. Also included are a few small areas that have slopes of more than 8 percent and a few areas of flood plains that are subject to occasional flooding. Because this complex includes built-up urban areas that have many closely placed buildings, parking lots, and streets, areas have not been investigated so thoroughly as areas of surrounding soils; therefore, mapped areas contain more inclusions than the surrounding areas.

Most limitations are caused by the very rapid runoff from Urban land and the potential of sinkhole formation in the Hagerstown soils. Ground water pollution is a hazard if the soils are used for waste disposal. Not assigned to a capability subclass.

Vanderlip Series

The Vanderlip series consists of deep, well drained soils that formed in limy sandstone and quartzite residuum. These gently sloping to moderately steep soils are on uplands.

In a representative profile 2 inches of hardwood leaf litter covers a surface layer of very dark gray loamy sand about 2 inches thick. The subsurface layer is yellowish brown loamy sand 20 inches thick. The subsoil is light brown channery loamy sand 28 inches thick. It has brown sandy loam bands scattered throughout. The substratum is reddish yellow channery loamy sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is low to moderate. Most limitations are related to slope, rapid permeability, and the loamy sand surface layer.

Most of the acreage of these soils is in woodland.

Representative profile of Vanderlip loamy sand, 5 to 20 percent slopes, in woodland 100 feet northwest of old U.S. 220 on bank of sand quarry, 2.7 miles northeast of Milesburg in Boggs Township:

O1—2 inches to 0; hardwood leaf litter.

A1—0 to 2 inches; very dark gray (10YR 3/1) loamy sand; weak fine granular structure; very friable, nonsticky and nonplastic; very strongly acid; clear smooth boundary.

A2—2 to 22 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose, nonsticky and nonplastic; 5 percent coarse fragments; strongly acid; gradual smooth boundary.

B2—22 to 50 inches; light brown (7.5YR 6/4) channery loamy sand matrix, brown (7.5YR 4/4) sandy loam lamellae ⅛ inch to 2 inches thick, totaling about 5 inches; single grained matrix, massive lamellae; very friable, nonsticky and nonplastic matrix, friable, nonsticky and nonplastic lamellae; 20 percent coarse fragments; common faint clay bridging of sand grains in lamellae; medium acid; gradual wavy boundary.

C—50 to 60 inches; reddish yellow (7.5YR 6/6) channery loamy sand; single grained; loose, nonsticky and nonplastic; 25 percent coarse fragments; medium acid.

The solum ranges from 40 to 65 inches in thickness. Depth to bedrock is more than 8 feet. Content of coarse fragments, mainly sandstone, ranges from 0 to 20 percent in the upper part of the solum, from 0 to 40 percent in the lower part of the solum, and from 0 to 70 percent in the C horizon. If these soils are not limed, reaction ranges from very strongly acid to medium acid throughout.

In undisturbed areas, the A1 horizon is thin and is black (10YR 2/1) to dark grayish brown (2.5Y 4/2). The A2 horizon is brown (7.5YR 5/2) to brownish yellow (10YR 6/6). The B horizon matrix is brown (7.5YR 5/4) to olive yellow (2.5Y 6/6). It is loamy sand or sand. Lamellae in the B horizon range from brown (10YR 4/3) to strong brown (7.5YR 5/6) in color and are always darker than the matrix. They are loamy sand or sandy loam. They are ⅛ inch to 4 inches thick and total less than 6 inches within a depth of 60 inches. The C horizon is generally similar to the B horizon matrix in color and texture.

Vanderlip soils are associated with the deep, well drained Morrison, Hazleton, and Leetonia soils. They contain more sand than Morrison soils, contain more sand and fewer coarse fragments than Hazleton soils, and contain fewer coarse fragments than Leetonia soils and do not have the Bh horizon characteristic of Leetonia soils.

VaC—Vanderlip loamy sand, 5 to 20 percent slopes. This gently sloping to moderately steep soil is in mainly convex areas on uplands. Areas generally range from 5 to 40 acres in size. Runoff is medium, and the erosion hazard is moderate in uncultivated areas.

Included with this soil in mapping are a few small areas of nearly level Vanderlip soils. Also included are a few small areas of soils that are similar to Vanderlip soils but that have bedrock within a depth of 8 feet. Small areas of Morrison, Hazleton, and Leetonia soils are also included.

Most of the acreage is in woodland. This soil is well suited to woodland. The gently sloping areas are also well suited to permanent hay and pasture.

Most limitations are caused by the slope, the rapid permeability, and the loamy sand surface layer. Capability subclass IVs.

Weikert Series

The Weikert series consists of shallow, well drained soils that formed in shale and siltstone residuum. These gently sloping to very steep soils are in convex areas on uplands.

In a representative profile the surface layer is very dark brown shaly silt loam about 2 inches thick. The subsurface layer is yellowish brown very shaly silt loam 5 inches thick. The subsoil is yellowish brown very shaly silt loam 5 inches thick. The substratum is light olive brown very shaly silt loam 5 inches thick. Fractured shale bedrock interbedded with fine grained sandstone is at a depth of 17 inches.

Permeability is moderately rapid, and available water capacity is very low. Most limitations are related to the shallow depth to rippable bedrock, the slope, and the many coarse fragments throughout the profile.

Most of the acreage of these soils is in woodland.

Representative profile of Weikert shaly silt loam in an area of Berks and Weikert soils, steep, in woodland, along the edge of a small shale pit, 150 feet northwest of U.S. 220 and 322, 1.9 miles northeast of Port Matilda in Worth Township:

A1—0 to 2 inches; very dark brown (10YR 2/2) shaly silt loam; weak very fine granular structure; very friable, slightly sticky and slightly plastic; 30 percent coarse ragments; strongly acid; abrupt smooth oundary.

A2—2 to 7 inches; yellowish brown (10YR 5/4) very shaly silt loam; moderate coarse granular structure; friable, slightly sticky and slightly plastic; 50 percent coarse fragments; very strongly acid; clear wavy boundary.

B2—7 to 12 inches; yellowish brown (10YR 5/4) very shaly silt loam; moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; 65 percent coarse fragments; very strongly acid; clear wavy boundary.

C—12 to 17 inches; light olive brown (2.5Y 5/4) very shaly silt loam; weak thick platy structure; friable, slightly sticky and nonplastic; 80 percent coarse fragments; very strongly acid; gradual wavy boundary.

R—17 inches; fractured shale and interbedded fine grained sandstone bedrock.

The solum ranges from 10 to 18 inches in thickness. Depth to rippable bedrock ranges from 1 foot to 1½ feet. Coarse fragments of shale, siltstone, and fine grained sandstone make up 20 to 50 percent of the upper part of the solum, 30 to 65 percent of the lower part of the solum, and 60 to 85 percent of the C horizon. If these soils are not limed, reaction is strongly acid or very strongly acid throughout.

In undisturbed areas, these soils have thin A1 and A2 horizons. The A1 horizon is black (10YR 2/1) to very dark grayish brown (2.5Y 3/2). The A2 horizon is generally yellowish brown (10YR 5/4 or 5/6). It is shaly silt loam or loam. The B horizon is generally brown (10YR 4/3) to brownish yellow (10YR 6/6), however, it is reddish yellow (7.5YR 6/6) in places. It is very shaly or shaly silt loam or loam. The C horizon is similar to the B horizon in texture.

Weikert soils are associated with the moderately deep, well drained Berks soils; the moderately deep,

poorly drained Markes soils; the deep, moderately well drained Wharton and Ernest soils; and the deep, poorly drained Brinkerton soils.

WeC—Weikert shaly silt loam, 5 to 15 percent slopes. This gently sloping to sloping soil is in convex areas on ridgetops. Areas generally range from 3 to 20 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of nearly level, moderately steep, or very stony Weikert soils. Also included are a few small areas of soils that are similar to Weikert soils but that have bedrock within a depth of 10 inches. Small areas of Berks, Markes, and Wharton soils are also included.

Most of the acreage is in woodland. This soil is suited to woodland. Because of the very low available water capacity and the slope, the soil is very limited for crops or pasture.

Most limitations are caused by the shallow depth to rippable bedrock, the slope, and the many coarse fragments throughout the profile. Capability subclass IVe.

WeD—Weikert shaly silt loam, 15 to 25 percent slopes. This moderately steep soil is in convex areas on side slopes of ridges. Areas generally range from 3 to 20 acres in size. Runoff is rapid, and the erosion hazard is high in cultivated areas.

Included with this soil in mapping are a few small areas of sloping, steep, or very stony Weikert soils. Also included are a few small areas of soils that are similar to Weikert soils but that have bedrock within a depth of 10 inches. Small areas of Berks and Wharton soils are also included.

Most of the acreage is in woodland. This soil is suited to woodland. The very low available water capacity, the slope, and the shallow depth to bedrock severely limit the use of the soil for most farm uses.

Most limitations are caused by the shallow depth to rippable bedrock, the slope, and the many coarse fragments throughout the profile. Capability subclass VIe.

Wharton Series

The Wharton series consists of deep, moderately well drained soils that formed in clay shale and siltstone residuum. These nearly level to sloping soils are in concave positions on uplands.

In a representative profile in a cultivated area, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is yellowish brown and brown silty clay loam, clay loam, and shaly clay loam 37 inches thick. It has grayish brown and strong brown mottles below a depth of 25 inches. The substratum is brown and dark grayish brown shaly clay loam to a depth of 74 inches. It has light brownish gray and gray mottles and has common black coatings.

Permeability is moderately slow, and available water capacity is high. A seasonal high water table is at a depth of 1½ to 3 feet during wet periods. Most limitations are related to the seasonal high water table, moderately slow permeability, and slope.

Most of the acreage of these soils is in woodland. Some areas are in cropland or pasture.

Representative profile of Wharton silt loam, 3 to 8 percent slopes, in cropland, 150 feet east of T–405, 1.5 miles northeast of Clarence in Snow Shoe Township:

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B21t—12 to 25 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine and medium subangular blocky structure; friable, sticky and plastic; 5 percent coarse fragments; common faint clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

B22t—25 to 31 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/8) mottles; light brownish gray (2.5Y 6/2) prism faces; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; friable, sticky and slightly plastic; 10 percent coarse fragments; common faint clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

B23t—31 to 49 inches; brown (10YR 5/3) shaly clay loam; common fine distinct grayish brown (2.5Y 5/2) mottles and few fine distinct strong brown (7.5YR 5/6) mottles; light brownish gray (2.5Y 6/2) prism faces; weak coarse prismatic structure parting to moderate medium subangular blocky; firm, sticky and slightly plastic; 15 percent coarse fragments; few faint clay films on ped faces and in pores; very strongly acid; clear wavy boundary.

C1—49 to 60 inches; brown (10YR 4/3) shaly clay loam; common fine faint light brownish gray (10YR 6/2) mottles; massive; firm in place, slightly sticky and slightly plastic; 25 percent coarse fragments; few faint clay films in pores; common prominent black coatings; very strongly acid; clear wavy boundary.

C2—60 to 74 inches; dark grayish brown (10YR 4/2) shaly clay loam; few medium faint gray (10YR 5/1) mottles; massive; firm in place, sticky and slightly plastic; 20 percent coarse fragments; few faint clay films in pores; common prominent black coatings; very strongly acid.

The solum ranges from 30 to 60 inches in thickness. Depth to bedrock ranges from 3½ to 6 feet or more. Coarse fragments of mostly shale and siltstone make up less than 15 percent of the Ap horizon and the upper part of the B horizon, but range from 5 to 40 percent in the B3 horizon and to 70 percent in the C horizon. If these soils are not limed, reaction is strongly acid or very strongly acid in the solum and is very strongly acid or extremely acid in the C horizon.

The Ap horizon is dark grayish brown (2.5Y 4/2) to brown (10YR 5/3). The upper part of the B horizon

is yellowish brown (10YR 5/8) to strong brown (7.5YR 5/6) or brown (10YR 5/3), and it is not generally mottled. The lower part of the B horizon is similar to the upper part, but it is mottled and ped and prism faces are gray (10YR 5/1) to light yellowish brown (2.5Y 6/4). The fine earth fraction of the B horizon is silty clay loam to clay. The C horizon is dark grayish brown (2.5Y 4/2) to yellowish brown (10YR 5/6) and is mottled. It generally is shaly or very shaly silt loam to clay.

Wharton soils are associated with the moderately deep, well drained Gilpin and Berks soils; the deep, well drained Rayne soils; the shallow, well drained Weikert soils; the deep, somewhat poorly drained Cavode soils; the deep, poorly drained Armagh and Brinkerton soils; the deep, moderately well drained Ernest soils; and the moderately deep, poorly drained Markes soils. Wharton soils do not have the fragipan that is characteristic of Ernest and Brinkerton soils.

WhA—Wharton silt loam, 0 to 3 percent slopes. This nearly level soil is in flat to concave areas on ridgetops. Areas generally range from 2 to 30 acres in size. Runoff is slow, and the erosion hazard is slight in uncultivated areas.

Included with this soil in mapping are a few small areas of gently sloping and very stony Wharton soils. Also included are a few small areas of soils that are similar to Wharton soils but that have less clay in the subsoil and of soils that contain more than 15 percent coarse fragments in the surface layer and upper part of the subsoil. Small areas of Cavode, Rayne, Ernest, Markes, Berks, and Gilpin soils are also included.

Most of the acreage is in woodland. This soil is very well suited to woodland. It is well suited to other farm uses, but the seasonal high water table delays tillage in spring. Alfalfa and winter grain are affected by frost heaving. If the soil is cultivated, stripcropping and using diversion terraces and drainage field ditches help to control erosion, retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and moderately slow permeability. Capability subclass IIw.

WhB—Wharton silt loam, 3 to 8 percent slopes. This gently sloping soil is in concave areas on ridgetops. Areas generally range from 2 to 40 acres in size. Runoff is medium and the erosion hazard is moderate in cultivated areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of nearly level, sloping, or very stony Wharton soils. Also included are a few small areas of soils that are similar to Wharton soils but that have less clay in the subsoil and of soils that contain more than 15 percent coarse fragments in the surface layer and upper part of the subsoil. Small areas of Cavode, Rayne, Ernest, Berks, and Gilpin soils are also included.

Much of the acreage is in woodland, but a considerable area is used for pasture and cropland. The soil is very well suited to woodland and is well suited to other farm uses, but the seasonal high water table delays tillage in spring. Alfalfa and winter grain are affected by frost heaving. If the soil is cultivated, stripcropping and using diversion terraces and waterways help to control erosion, retain soil nutrients, and allow tillage earlier in spring.

Most limitations are caused by the seasonal high water table and moderately slow permeability. Capability subclass IIe.

WhC—Wharton silt loam, 8 to 15 percent slopes. This sloping soil is in concave areas on the upper side slopes of ridges. Areas generally range from 2 to 30 acres in size. Runoff is medium to rapid, and the erosion hazard is moderate to high in cultivated areas.

Included with this soil in mapping are a few small areas of gently sloping, moderately steep, and very stony Wharton soils. Also included are a few small areas of soils that are similar to Wharton soils but that have less clay in the subsoil and of soils that contain more than 15 percent coarse fragments in the surface layer and upper part of the subsoil. Small areas of Rayne, Berks, Gilpin, and Ernest soils are also included.

Much of the acreage is in woodland, but some areas are in cropland or pasture. This soil is very well suited to woodland, and it is well suited to pasture and hay. Alfalfa and winter grain are affected by frost heaving. The seasonal high water table delays the use of the soil in the spring. Stripcropping and using diversion terraces and waterways are necessary to help control erosion and retain soil nutrients if the soil is cultivated.

Most limitations are caused by slope, seasonal high water table, and moderately slow permeability. Capability subclass IIIe.

Wyoming Series

The Wyoming series consists of deep, somewhat excessively drained soils that formed in materials washed from uplands underlain by sandstone. These nearly level and gently sloping soils are on low terraces along intermittent drainageways.

In a representative profile in a wooded area, 2 inches of organic material covers a surface layer of dark brown gravelly sandy loam about 4 inches thick. The subsurface layer is brown gravelly sandy loam 9 inches thick. The subsoil is brown very gravelly sandy loam 9 inches thick. The substratum is brown very gravelly sandy loam to a depth of 64 inches.

Permeability is rapid, and available water capacity is very low to low. This soil is rarely flooded. A seasonal high water table rises to a depth of 3 feet during wet periods. Most limitations are related to rare flooding and the many coarse fragments throughout the profile.

Most of the acreage of these soils is in woodland.

Representative profile of Wyoming gravelly sandy loam, rarely flooded, 0 to 5 percent slopes, in woodland, 50 feet southeast of the southbound part of the road through the State Game Lands No. 176, 0.5 mile northeast of its junction with T-307, 2.0 miles northeast of Gatesburg in Ferguson Township:

O1—2 inches to 1 inch; undecomposed organic matter and roots.

O2—1 inch to 0; black (10YR 2/1) mostly decomposed organic material.

A1—0 to 4 inches; dark brown (10YR 3/3) gravelly sandy loam; single grained and weak

fine granular structure; loose, nonsticky and nonplastic; 25 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—4 to 13 inches; brown (10YR 4/3) gravelly sandy loam; single grained; loose, nonsticky and nonplastic; 45 percent coarse fragments; strongly acid; abrupt wavy boundary.

B—13 to 22 inches; brown (7.5YR 4/4) very gravelly sandy loam; weak very fine subangular blocky structure; very friable, slightly sticky and nonplastic; 55 percent coarse fragments; strongly acid; clear wavy boundary.

C—22 to 64 inches; brown (7.5YR 5/4) very gravelly sandy loam; single grained; loose, nonsticky and nonplastic; 60 percent coarse fragments; strongly acid.

The solum ranges from 18 to 35 inches in thickness. Depth to bedrock is more than 6 feet. Content of coarse fragments, dominantly water-rounded gray sandstone, ranges from 15 to 50 percent in the A horizon, 20 to 60 percent in the B horizon, and 40 to 75 percent in the C horizon. If these soils are not limed, reaction ranges from extremely acid to medium acid throughout.

In undisturbed areas, the A1 horizon is thin, is black (10YR 2/1) to dark brown (10YR 3/3), and is generally covered by a thin, black organic horizon. The A2 horizon is generally very dark grayish brown (10YR 3/2) to brown (7.5YR 5/4). The B horizon is dark brown (10YR 4/3) to reddish brown (5YR 5/4). It is generally gravelly or very gravelly coarse sandy loam or sandy loam. The C horizon is similar to the B horizon in color, but it has a chroma of 2 in places. It is generally very gravelly or very cobbly sandy loam or loamy sand.

Wyoming soils are closely associated with the deep, well drained Morrison soils on uplands. They contain more coarse fragments throughout and less clay in the B horizon than Morrison soils.

WyA—Wyoming gravelly sandy loam, rarely flooded, 0 to 5 percent slopes. This nearly level to gently sloping soil is in flat areas along intermittent drainageways of sandy barrens. Areas generally range from 3 to 30 acres in size. The soil is subject to rare flooding, and a water table rises to within 3 feet of the surface during extremely wet seasons. Runoff is slow, and the erosion hazard is slight to moderate if no flooding occurs.

Included with this soil in mapping are a few small areas of nongravelly or very stony Wyoming soils. Also included are a few small areas of soils in and along intermittent drainageways that are similar to Wyoming soils but that are flooded more frequently. Small areas of Morrison soils are also included.

Most of the acreage is used for woodland. This soil is suited to crops and pasture. Because the soil is in long, narrow areas and is inaccessible in sandy barrens, tillage is generally impractical.

Most limitations are caused by the many coarse fragments throughout the profile, rare flooding, rapid permeability, and low available water capacity. Capability subclass IIIs.

Use and Management of the Soils

This section relates the soils of the county to various uses and methods of management. It explains the system of capability classification used by the Soil Conservation Service and discusses the use of the soils for crops and pasture, as woodland, and for the elements of wildlife habitat. It provides data on engineering properties of the soils and gives interpretations of these properties as they affect road construction and conservation engineering. This section also explains the limitations of the soils for community development and recreation.

Crops and Pasture[2]

In the following pages the capability classification is explained, and yields are given for specified crops. The principal crops grown in the county are corn, wheat, oats, and hay. Some peas, sweet corn, and beans are grown for canning, and some potatoes are also grown.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, all kinds of soil are grouped at three levels; the capability class, subclass, and unit. These levels are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove,

[2] ROBERT L. BOND, State resource conservationist, Soil Conservation Service, helped prepare this section.

that limit their use largely to pasture, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In Centre County, the soils are classified only at the capability class and subclass levels. The management needs for crops and pasture are discussed in the descriptions of the mapping units in the section "Descriptions of the Soils."

The mapping unit description mentions the conservation practices needed to control erosion, to reduce runoff, and to retain soil nutrients. It also tells of artificial drainage practices needed to increase the suitability for crops.

Conservation practices that help to control erosion and reduce runoff are stripcropping, contour farming, cover cropping, and using grass crops and diversions.

Drainage practices that increase the suitability for crops and allow tillage or use earlier in spring are surface field drains, surface main and lateral drains, subsurface drains, diversions, and sod waterways.

Estimated yields

Table 2 shows estimates of yields of the principal crops grown in Centre County. The estimates are averages for a period of 10 years or more. It is estimated that yields will increase 10 to 25 percent by 1985 as a result of development of new varieties and improvements in the technology of production. Yields increased 2 percent per year in Pennsylvania during the 1960's. Yield estimates given in table 2 are those to be expected under intensive management.

Intensive management for cultivated crops consists of providing surface and internal drainage for optimum growing conditions where natural drainage is restricted; applying lime, phosphate, potash, nitrogen, and other elements according to crop needs indicated by soil tests; returning all crop residue to the soil and, if low residue crops are grown, supplying organic matter by growing cover crops and by applying manure or other organic material; minimizing tillage by limiting seedbed preparation to that needed for crop production, by avoiding tillage when the soils are wet, by delaying spring tillage until planting time, and by leaving fall plowed fields rough during winter; adequately controlling weeds and insects; selecting crop variety and seed quality and considering plant population for a specified soil or location; keeping erosion within tolerated limits; and keeping field operations timely.

Intensive management for hay and pasture crops consists of providing surface and internal drainage for optimum growing conditions; applying lime and fertilizer at seeding time according to crop needs and the needs indicated by soil tests and also applying topdressing as needed; reseeding and reestablishing stands regularly; selecting grass-legume stands of high quality, and considering crop variety for specified soil and location; keeping haymaking operations timely; and deferring and rotating grazing as needed.

Woodland[3]

Centre County originally had a dense cover of trees. However, clearing for housing and farming plus cutting for commercial purposes eliminated all of the virgin stands of timber. Now the commercial woodland, which occupies 77 percent of the land area, consists of second- and third-growth stands.

The principal forest cover types that make up the present woodland and the proportionate extent of each as given by the Forest Service (*5*) are discussed in the following paragraphs.

The white pine forest type makes up 6.9 percent of the total commercial woodland in the county. Eastern white pine occupies 50 percent or more of the stand. Associated trees are yellow-poplar, northern red oak, and white oak.

The elm-ash-red maple forest type makes up 8.1 percent of the total commercial woodland in the county. American elm, white ash, and red maple predominate. Associated trees are slippery elm, yellow birch, black gum, sycamore, and hemlock.

The maple-beech-birch forest type makes up 9.5 percent of the total commercial woodland in the county.

[3] V. C. MILES, woodland conservationist, Soil Conservation Service, helped prepare this section.

TABLE 2.—*Estimated yields per acre of field and forage crops*

[The absence of data indicates that the soil is not suited to the specified crop]

Soil	Corn		Oats	Wheat	Hay		Pasture	
	Grain	Silage			Alfalfa-grass mixture	Grass-legume mixture	Bluegrass	Tall grass
	Bu	*Tons*	*Bu*	*Bu*	*Tons*	*Tons*	*AUM* [1]	*AUM* [1]
Albrights silt loam, 3 to 8 percent slopes	100	20	70	40	3.5	3.0	4.5	6.5
Albrights silt loam, 8 to 15 percent slopes	90	18	65	40	3.5	3.0	4.5	6.5
Albrights very stony silt loam, 0 to 8 percent slopes							3.5	
Albrights very stony silt loam, 8 to 15 percent slopes							3.0	
Allegheny silt loam, 2 to 8 percent slopes	120	24	75	45	4.5	3.5	5.5	8.5
Andover channery loam, 0 to 8 percent slopes	85	17	60			2.5	4.0	5.0
Andover channery loam, 8 to 15 percent slopes	75	15	55			2.5	4.0	5.0
Andover very stony loam, 0 to 8 percent slopes								
Andover very stony loam, 8 to 15 percent slopes								
Armagh silt loam, 0 to 3 percent slopes	80	16	60			2.5	4.0	5.0
Armagh silt loam, 3 to 8 percent slopes	80	16	60			2.5	4.0	5.0
Atkins silt loam	100	20	60	30		3.0	4.5	5.5
Basher loam	120	24	80	45	4.5	3.5	5.5	8.5
Berks shaly silt loam, 3 to 8 percent slopes	80	16	60	35	3.5	3.0	4.5	6.5
Berks shaly silt loam, 8 to 15 percent slopes	75	15	55	35	3.0	2.5	4.0	5.5
Berks shaly silt loam, 15 to 25 percent slopes	70	14	50	30	3.0	2.0	3.0	5.5
Berks very stony silt loam, 8 to 25 percent slopes							2.5	
Berks and Weikert soils, steep								
Brinkerton silt loam, 0 to 3 percent slopes	90	18	60			2.5	4.0	5.0
Brinkerton silt loam, 3 to 8 percent slopes	90	18	60			2.5	4.0	5.0
Brinkerton silt loam, 8 to 15 percent slopes	80	16	55			2.5	4.0	5.0
Brinkerton very stony silt loam, 0 to 8 percent slopes								
Buchanan loam, 2 to 8 percent slopes	100	20	65	40	3.5	3.0	4.5	6.5
Buchanan channery loam, 3 to 8 percent slopes	100	20	65	40	3.5	3.0	4.5	6.5
Buchanan channery loam, 8 to 15 percent slopes	90	18	60	35	3.5	3.0	4.5	6.5
Buchanan extremely stony loam, 0 to 8 percent slopes								
Buchanan extremely stony loam, 8 to 25 percent slopes								
Carlisle muck								
Cavode silt loam, 0 to 3 percent slopes	85	17	65	35		3.0	4.5	5.5
Cavode silt loam, 3 to 8 percent slopes	85	17	65	35		3.0	4.5	5.5
Chagrin soils	130	26	80	50	5.0	3.5	5.5	8.5
Clarksburg silt loam, 0 to 3 percent slopes	100	20	70	40	3.5	3.0	4.5	6.5
Clarksburg silt loam, 3 to 8 percent slopes	100	20	70	40	3.5	3.0	4.5	6.5
Clymer sandy loam, 3 to 8 percent slopes	120	24	75	45	4.5	3.5	5.5	8.5
Clymer sandy loam, 8 to 15 percent slopes	110	22	70	40	4.0	3.0	4.5	7.5
Clymer very stony sandy loam, 0 to 8 percent slopes							3.0	
Clymer very stony sandy loam, 8 to 25 percent slopes							3.0	
Dunning silty clay loam	90	18				3.0	4.5	5.5
Edom silt loam, 2 to 8 percent slopes	100	20	70	40	4.0	3.0	4.5	7.5
Edom silt loam, 8 to 15 percent slopes	90	18	65	35	3.5	3.0	4.5	6.5
Edom silt loam, 15 to 25 percent slopes	80	16	60	35	3.0	2.5	4.0	5.5
Ernest channery silt loam, 3 to 8 percent slopes	100	20	65	40	3.5	3.0	4.5	6.5
Ernest channery silt loam, 8 to 15 percent slopes	95	19	60	35	3.5	3.0	4.5	6.5
Ernest channery silt loam, 15 to 25 percent slopes	90	18	55	35	3.0	2.5	4.0	5.5
Ernest very stony silt loam, 3 to 8 percent slopes							3.5	
Ernest very stony silt loam, 8 to 25 percent slopes							3.0	
Gilpin channery silt loam, 2 to 8 percent slopes	90	18	65	40	3.5	3.0	4.5	7.0
Gilpin channery silt loam, 8 to 15 percent slopes	85	17	60	35	3.5	3.0	4.5	7.0
Gilpin channery silt loam, 15 to 25 percent slopes	80	16	55	30	3.0	2.5	4.0	6.0
Hagerstown silt loam, 0 to 3 percent slopes	135	27	80	50	5.0	3.5	5.5	9.5
Hagerstown silt loam, 3 to 8 percent slopes	135	27	80	50	5.0	3.5	5.5	9.5

TABLE 2.—*Estimated yields per acre of field and forage crops*—Continued

Soil	Corn		Oats	Wheat	Hay		Pasture	
	Grain	Silage			Alfalfa-grass mixture	Grass-legume mixture	Blue-grass	Tall grass
	Bu	*Tons*	*Bu*	*Bu*	*Tons*	*Tons*	*AUM* [1]	*AUM* [1]
Hagerstown silt loam, 8 to 15 percent slopes	125	25	75	45	4.5	3.0	4.5	8.5
Hagerstown silty clay loam, 3 to 8 percent slopes	125	25	75	45	5.0	3.5	5.5	9.0
Hagerstown silty clay loam, 8 to 15 percent slopes	120	24	70	40	4.5	3.5	5.0	8.5
Hagerstown silty clay loam, 15 to 25 percent slopes	110	22	65	35	4.0	3.0	5.0	8.0
Hazleton channery sandy loam, 3 to 8 percent slopes	125	25	75	45	4.5	3.5	5.5	8.5
Hazleton channery sandy loam, 8 to 15 percent slopes	115	23	70	40	4.5	3.5	5.0	8.0
Hazleton channery sandy loam, 15 to 25 percent slopes	110	22	60	35	4.0	3.0	4.5	7.5
Hazleton extremely stony sandy loam, gently sloping								
Hazleton extremely stony sandy loam, moderately steep								
Hazleton-Dekalb association, very steep								
Hublersburg silt loam, 0 to 3 percent slopes	130	26	80	50	5.0	3.5	5.5	9.5
Hublersburg silt loam, 3 to 8 percent slopes	130	26	80	50	5.0	3.5	5.5	9.5
Hublersburg silt loam, 8 to 15 percent slopes	120	24	75	45	4.5	3.0	4.5	8.5
Hublersburg silt loam, 15 to 25 percent slopes	110	22	70	40	4.0	3.0	4.5	7.5
Laidig channery loam, 3 to 8 percent slopes	100	20	70	40	4.0	3.0	4.5	7.5
Laidig channery loam, 8 to 15 percent slopes	95	19	65	35	4.0	3.0	4.5	7.5
Laidig channery loam, 15 to 25 percent slopes	85	17	60	30	3.5	2.5	4.0	6.5
Laidig extremely stony loam, 0 to 8 percent slopes								
Laidig extremely stony loam, 8 to 25 percent slopes								
Laidig extremely stony loam, steep								
Leck Kill channery silt loam, 3 to 8 percent slopes	120	24	75	50	4.5	3.0	5.5	8.5
Leck Kill channery silt loam, 8 to 15 percent slopes	115	23	70	45	4.0	3.0	4.5	7.5
Leck Kill channery silt loam, 15 to 25 percent slopes	105	21	65	40	4.0	2.5	4.0	7.5
Leck Kill very stony silt loam, 0 to 8 percent slopes							4.5	
Leck Kill very stony silt loam, 8 to 25 percent slopes							3.5	
Leck Kill and Calvin soils, steep								
Leetonia extremely stony loamy sand, 0 to 12 percent slopes								
Leetonia sand, variant, 3 to 8 percent slopes	60	12	50	30	3.0	2.0	3.0	5.5
Leetonia sand, variant, 8 to 15 percent slopes							2.5	
Lindside soils	130	26	80	45	4.5	3.5	5.5	8.5
Markes silt loam, 2 to 10 percent slopes	70	14	55			2.5	4.0	5.0
Meckesville silt loam, 3 to 8 percent slopes	100	20	70	40	4.0	3.0	4.5	7.5
Meckesville silt loam, 8 to 15 percent slopes	95	19	65	35	4.0	3.0	4.5	7.5
Meckesville very stony silt loam, 0 to 8 percent slopes							3.5	
Meckesville very stony silt loam, 8 to 25 percent slopes							3.0	
Melvin silt loam	115	23	70			3.5	4.5	6.5
Millheim silt loam, 2 to 8 percent slopes	100	20	70	40	4.0	3.0	4.5	7.5
Millheim silt loam, 8 to 15 percent slopes	90	18	65	35	3.5	3.0	4.5	6.5
Millheim silt loam, 15 to 25 percent slopes	80	16	60	35	3.5	3.0	4.5	5.5
Monongahela silt loam, 2 to 8 percent slopes	100	20	65	40	3.5	3.0	4.5	6.5
Morrison sandy loam, 2 to 8 percent slopes	105	21	65	40	4.5	3.5	5.5	8.5
Morrison sandy loam, 8 to 15 percent slopes	100	20	60	35	4.0	3.5	5.5	7.5
Morrison sandy loam, 15 to 25 percent slopes	90	18	55	30	4.0	3.0	4.5	7.5
Morrison very stony sandy loam, 0 to 8 percent slopes							3.0	
Morrison very stony sandy loam, 8 to 25 percent slopes							3.0	
Morrison very stony sandy loam, steep								
Murrill channery silt loam, 0 to 3 percent slopes	120	24	75	45	4.5	3.5	5.5	8.5

TABLE 2.—*Estimated yields per acre of field and forage crops*—Continued

Soil	Corn		Oats	Wheat	Hay		Pasture	
	Grain	Silage			Alfalfa-grass mixture	Grass-legume mixture	Blue-grass	Tall grass
	Bu	*Tons*	*Bu*	*Bu*	*Tons*	*Tons*	*AUM* [1]	*AUM* [1]
Murrill channery silt loam, 3 to 8 percent slopes	120	24	75	45	4.5	3.5	5.5	8.5
Murrill channery silt loam, 8 to 15 percent slopes	110	22	70	40	4.0	3.0	4.5	7.5
Murrill channery silt loam, 15 to 25 percent slopes	95	19	60	35	4.0	3.0	4.5	7.5
Murrill very stony silt loam, 0 to 8 percent slopes							4.5	
Murrill very stony silt loam, 8 to 25 percent slopes							3.5	
Nolin silt loam, local alluvium, 0 to 5 percent slopes	135	27	80	50	5.0	3.5	5.5	9.5
Opequon-Hagerstown complex, 3 to 8 percent slopes	75	15	55	25	3.0	2.5	4.0	5.5
Opequon-Hagerstown complex, 8 to 15 percent slopes	70	14	50	25	3.0	2.5	4.0	5.5
Opequon-Hagerstown complex, 15 to 25 percent slopes					2.5	2.0	3.0	5.0
Opequon-Hagerstown complex, steep								
Opequon-Rock outcrop complex, 0 to 8 percent slopes							3.0	
Opequon-Rock outcrop complex, 8 to 25 percent slopes							2.5	
Philo loam	130	26	80	45	4.5	3.5	5.5	8.5
Philo and Atkins very stony soils							3.5	
Pope soils	135	27	80	50	5.0	3.5	5.5	9.5
Purdy silt loam	80	16	55			2.5	4.0	5.0
Rayne silt loam, 2 to 10 percent slopes	115	23	75	45	4.5	3.5	5.5	8.5
Rubble land								
Strip mines, acid. Too variable to estimate.								
Tyler silt loam	95	19	65		3.0	3.0	4.5	5.5
Ungers channery loam, 3 to 8 percent slopes	120	24	75	45	4.5	3.5	5.5	8.5
Ungers channery loam, 8 to 15 percent slopes	110	22	70	40	4.0	3.0	4.5	7.5
Ungers channery loam, 15 to 25 percent slopes	95	19	60	35	4.0	3.0	4.5	7.5
Ungers very stony loam, 0 to 8 percent slopes							4.5	
Ungers very stony loam, 8 to 25 percent slopes							3.5	
Urban land-Hagerstown complex, gently sloping								
Vanderlip loamy sand, 5 to 20 percent slopes	70	14	50	30	3.0	2.0	3.0	5.5
Weikert shaly silt loam, 5 to 15 percent slopes			45	20	2.0	2.0	3.0	4.0
Weikert shaly silt loam, 15 to 25 percent slopes							2.0	
Wharton silt loam, 0 to 3 percent slopes	90	18	65	40	3.5	3.0	4.5	6.5
Wharton silt loam, 3 to 8 percent slopes	90	18	65	40	3.5	3.0	4.5	6.5
Wharton silt loam, 8 to 15 percent slopes	80	16	60	35	3.5	3.0	4.5	6.5
Wyoming gravelly sandy loam, rarely flooded, 0 to 5 percent slopes	80	16	65	35	3.5	3.5	4.0	6.5

[1] Animal-unit-month (AUM) is a term used to express carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of months the pasture can be grazed during a single grazing season without injury to the sod. An animal unit is one cow, one steer, one horse, or one mule; five sheep; or seven hogs. An acre of pasture that provides 1 month of grazing for two cows, for example, has a carrying capacity of 2 animal-unit-months.

Sugar maple, beech, and yellow birch are the dominant species. Associated trees are basswood, red maple, hemlock, northern red oak, ash, white pine, black birch, and yellow-poplar.

The aspen-birch forest type makes up 7.9 percent of the total commercial woodland in the county. Quaking aspen, bigtooth aspen, and gray birch predominate. Principal associated trees are pin cherry, red maple, yellow birch, white pine, ash, and sugar maple.

The oak-hickory forest type makes up 64.1 percent of the total commercial woodland in the county. White oak, red oak, and hickory generally predominate, but in some areas black oak predominates. Principal associated trees include yellow-poplar, shagbark hickory, white ash, red maple, beech, and black gum and an understory of flowering dogwood.

The Virginia pine-pitch pine forest type makes up 2.4 percent of the total commercial woodland in the county. Virginia pine and pitch pine predominate. Principal associated trees are northern red oak, black oak, chestnut oak, scarlet oak, black gum, and hickory.

Other oak forest types make up 1.1 percent of the total commercial woodland in the county.

Farmers own 14 percent of the commercial forest

land, other private parties own 52.4 percent, the forest industry owns 2.0 percent, the Pennsylvania Game Commission owns 12.1 percent, and the Pennsylvania Department of Environmental Resources, Bureau of Forestry, owns 19.5 percent.

Sawtimber makes up approximately 41.7 percent of the acreage in commercial forests, poletimber 40.3 percent, and seedlings and saplings 16.7 percent. The remaining 1.3 percent is classified as nonstocked (*4*).

Good woodland management encourages the more desirable kinds of trees to grow. The soils and the climate are favorable. Help in planning a program of woodland improvement can be obtained from local technicians. How much effort a landowner is willing to make probably depends on general economic conditions.

The returns from soils that are excellent, very good, or good growing sites generally justifies the expenditure of money for management purposes. However, consideration should be given to the potential yield, quality of the particular species growing on the site, and the market potential. The species and proportion of poor quality trees growing on such sites in places prohibits the investment of money for management purposes. Also, the conversion of such areas from their present state to their potential capacity is not economically justifiable at times.

Soils that are fair growing sites are the most difficult to appraise for management. A thorough appraisal of the woodland to determine species and site quality is essential. Also, the market possibility should be investigated. A proper analysis of all of these interrelated factors is essential to determine the intensity of management.

The returns from the soils that are poor growing sites generally do not economically justify intensive management for the production of wood products.

Table 3 rates the concerns in management, lists suitable species, and shows the site quality of each soil for producing timber. Following are explanations of some of the columns in table 3.

Erosion hazard.—The ratings indicate the amount or intensity of practices required to reduce or control erosion. A rating of *slight* indicates that the risk of erosion is low when wood products are harvested, and that few, if any, practices are needed to control erosion. A rating of *moderate* indicates that erosion control measures are needed on skid trails and logging roads immediately after wood products are harvested. A rating of *severe* means that erosion, especially gullying, is a severe hazard when wood products are harvested. Harvesting and other operations should be done across the slope as much as possible. Skid trails and logging roads should be laid out on as low grades as possible, and water disposal systems should be carefully maintained during logging. Erosion control measures are needed on logging roads and skid trails immediately after logging.

Equipment limitations.—Ratings are based on the characteristics of the soils and topographic features that restrict or prohibit the use of equipment for harvesting trees or planting seedlings. Steepness of slope, stoniness, and wetness are the main soil limitations that restrict the use of equipment. The rating is *slight* if there are few limitations. It is *moderate* if some problems exist, such as stones and boulders on the surface, moderately steep slopes, or wetness of the soil for part of the year. The rating is *severe* if prolonged wetness of the soil, steepness, or stoniness severely limit the use of equipment. If the rating is severe, track-type equipment is best for general use, and winches or similar special equipment are needed for some kinds of work.

Seedling mortality.—Seedling mortality refers to the loss of naturally occurring or planted tree seedlings resulting from unfavorable characteristics of the soils. The rating is *slight* if no more than 25 percent of the planted seedlings are likely to die and satisfactory restocking from the initial planting can be expected. Adequate restocking ordinarily results from natural regeneration. A rating of *moderate* indicates that between 25 and 50 percent of planted seedlings are likely to die and some replanting is ordinarily needed. Natural regeneration cannot always be relied upon for adequate and early restocking. A rating of *severe* indicates that more than 50 percent of planted seedlings are likely to die and special preparation of the seedbed, superior planting techniques, and considerable replanting are needed for adequate and immediate restocking. Restocking cannot be expected to result from natural regeneration if the rating for seedling mortality is severe.

Plant competition.—Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade. Plant competition is *slight* if unwanted plants do not prevent adequate natural regeneration and early growth or interfere with adequate development of planted seedlings. It is *moderate* if competing plants delay natural or artificial regeneration, both establishment and growth, but do not prevent the natural development of a fully stocked normal stand. Competition is *severe* if adequate natural or artificial regeneration can be obtained only by intensive site preparation and maintenance, including weeding.

Windthrow hazard.—The ratings for windthrow hazard represent an evaluation of the factors that control the development of tree roots and consequently the likelihood that trees are uprooted by wind. A rating of *slight* indicates that normally no trees are blown down by the wind. A rating of *moderate* indicates that some trees are expected to be blown down during periods of excessive soil wetness and high wind. If the rating is *severe*, many trees are expected to be blown down during periods of soil wetness and moderate or high winds.

Species suitable.—The species suitable are trees that are best suited for planting or managing in existing stands. In planning the development of existing woodland, it is advisable to review this list of trees. The objectives of the landowner determines which species to favor in planting or seeding.

Site quality.—Site quality indicates the general ability of the soils to produce timber. The ratings are based on sample plots in this county and adjacent counties. Other soils in the county that have characteristics similar to those of the soils studied are assumed to have about the same rating. The ratings are based on the average height attained by the dominant and codominant trees at the age of 50 years. Foresters using this rating can determine the volume of timber

that normal stands produce at different ages. Yield information on oak is based on data by G. L. Schnur (*8*). A site index of 85 or better is rated *excellent,* and the expected yield at age 50 is 13,750 or more board feet per acre (published data for oak do not go beyond site index 80, International rule). A site index of 75 to 84 is rated *very good,* and the expected yield at age 50 is about 13,750 board feet per acre. A site index of 65 to 74 is rated *good,* and the expected yield at age 50 is about 9,750 board feet per acre. A site index of 55 to 64 is rated *fair,* and the expected yield at age 50 is about 6,300 board feet per acre. A site index of less than 54 is rated *poor,* and the expected yield at age 50 is less than 3,250 board feet per acre. Yield information for yellow-poplar is based on data from E. F. McCarthy (*7*). A site index of 95 or better is rated *excellent,* and the expected yield at age 50 is 32,150 board feet per acre. A site index of 85 to 95 is rated *very good,* and the expected yield at age 50 is about 24,400 board feet per acre. A site index of 75 to 85 is *good,* and the expected yield is 17,620 board feet per acre. A site index of 65 to 75 is *fair,* and the expected yield is 11,400 board feet per acre. A site index of 55 to 65 is *poor,* and the expected yield is 5,600 board feet per acre. The species column under site quality indicates the trees commonly found on the soil.

The site indexes for other trees, such as white pine, sugar maple, ash and black cherry, vary somewhat. The better sites have the taller trees of the same species at the age of 50 years. As the site quality decreases, the height of trees decreases accordingly. More information on site index for other tree species can be obtained from the United States Department of Agriculture, Soil Conservation Service, and the Pennsylvania Department of Environmental Resources, Bureau of Forestry.

Wildlife

Many species of animals, fish, and songbirds are found throughout Centre County. The soils, topography, and pattern of land use are favorable for increasing the kinds and numbers of these species.

All soils are capable of supporting some kind of wildlife, and every kind of soil is generally occupied by several game and nongame species. In planning land use, the soils that are most suitable for crops and that have the highest economic value are generally not used or devoted entirely to wildlife. Soils that are devoted mainly to wildlife are most often those that have severe limitations that make them unsuitable for cultivation.

The kinds and the abundance of wildlife depend largely on the type of habitat available. An area is inhabited by the wildlife that have their habitat requirements met by the vegetation in the area. The vegetation, in turn, depends greatly on the kinds of soil. If natural conditions of the area are altered by drainage, cultivation, or other practices used in managing farmland or woodland, the kinds and patterns of vegetation change. There can also be a change in the kinds and numbers of wildlife.

The soils in Centre County can be used for developing wildlife habitat on farms, in parks, in private or commercial shooting grounds, and in public and private wildlife refuges. Ponds can be built and stocked with fish. In addition, most of the present streams, lakes, and reservoirs have potential for greater use.

The following paragraphs describe the major kinds of wildlife in Centre County. Descriptions of the soil associations referred to can be found in the section "General Soil Map." The location of each soil association is shown on the general soil map at the back of this publication.

White-tailed deer are the most abundant large game animals in the county. They are generally considered a forest species of wildlife, but they prefer and grow best in areas where brush or young trees are interspersed with small open areas. They are generally distributed throughout the county, but the greatest concentrations are in the wooded areas on the soils of associations 1, 2, 10, and 11. A smaller concentration is in the central part of the county in associations 3, 4, and 6.

Black bear are common in the mountainous areas of Centre County. The greatest numbers are found in the northern part of the county in associations 1 and 2 north of U.S. 322. Lesser concentrations are also found on Nittany Mountain and in the Seven Mountains area of associations 10 and 11 in the eastern and southern parts of the county.

Wild turkey are abundant throughout the mountainous areas of the county. Turkey prefer mature forests that provide mast, but they range into open brushy land and cultivated fields during summer to feed. They are most commonly found in associations 1, 2, 10, and 11.

Ring-necked pheasant are the most abundant game birds in Centre County. Their range is limited mainly to the Nittany, Penns, and Brush Valley areas on the soils of associations 5, 7, 8, and 9. Lesser concentrations are also found in Bald Eagle Valley in associations 3 and 4. They are found mostly in areas of active farming.

Cottontail rabbits are fairly abundant in Centre County, but populations fluctuate considerably from year to year. They are found in the same areas as the ring-necked pheasant.

Gray squirrel populations also fluctuate greatly from year to year, depending on the food supply. They prefer woodlots that are interspersed with cropped areas. They are found mainly in associations 3, 4, 10, and 11.

Ruffed grouse populations are quite limited, but some are found in the mountains of the extreme northern part of the county and in the mountains of the southern and eastern parts. Population densities depend on the food supply.

Woodcock are found in limited numbers mainly in the southern end of Nittany Valley and in Bald Eagle Valley. Mourning doves are common in the farming areas of the county.

Waterfowl, mainly mallard, black duck, and wood duck, are found where there is open water. These areas are mainly Sayers Dam, Black Moshannon Dam, Bald Eagle Creek, and Penns Creek.

Muskrat and beaver are the principal fur-bearing animals in the county. Muskrat are found in marshy areas, in farm ponds, and along small streams. Beaver are quite limited in number, and they are found mainly in the headwater areas of mountain streams.

TABLE 3.—*Soil interpretations*

Soil series and map symbols	Management concerns					
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard
				Conifers	Hardwoods	
Albrights: AbB, AcB	Slight	Slight	Slight	Moderate	Slight	Slight
AbC, AcC	Moderate	Slight	Slight	Moderate	Slight	Slight
Allegheny: AlB	Slight	Slight	Slight	Severe	Moderate	Slight
Andover: AnB, AoB	Slight	Severe	Severe	Moderate	Severe	Moderate
AnC, AoC	Moderate	Severe	Severe	Moderate	Severe	Moderate
Armagh: ArA, ArB	Slight	Severe	Severe	Moderate	Moderate	Moderate
Atkins: At	Slight	Severe	Severe	Severe	Severe	Moderate
Basher: Ba	Slight	Slight	Slight	Severe	Moderate	Slight
Berks: BkB, BkC, BkD, BlD.	Slight	Slight	Moderate	Moderate	Slight	Slight
BMF Interpretations for BMF apply to Weikert part of unit as well as to Berks part.	Moderate	Severe	Severe	Slight	Slight	Moderate
Brinkerton: BrA, BrB, BsB	Slight	Severe	Severe	Moderate	Moderate	Moderate
BrC	Moderate	Severe	Severe	Moderate	Moderate	Moderate
Buchanan: BtB, BuB, BuC	Slight	Slight	Slight	Moderate	Slight	Slight
BxB	Slight	Moderate	Slight	Moderate	Slight	Slight
BxD	Moderate	Moderate	Slight	Moderate	Slight	Slight
Carlisle: CA. Not suited to growing trees commercially.						

for woodland

Species suitable—		Site quality	
For favoring in existing stands	For planting or seeding	Rating	Species
Northern red oak, yellow-poplar, white ash, sugar maple, eastern white pine.	Eastern white pine, Norway spruce, European larch, yellow-poplar.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, yellow-poplar, white ash, sugar maple, eastern white pine.	Eastern white pine, Norway spruce, European larch, yellow-poplar.	Very good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, yellow-poplar, black walnut, sugar maple.	Eastern white pine, yellow-poplar, black walnut, European larch, Norway spruce.	Very good	Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.
Northern red oak, red maple, white ash, yellow-poplar, sugar maple.	Eastern white pine, European larch, white spruce, yellow-poplar, Norway spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, red maple, white ash, yellow-poplar, sugar maple.	Eastern white pine, European larch, white spruce, yellow-poplar, Norway spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, red maple, white ash, sugar maple.	Eastern white pine, European larch, white spruce, Norway spruce.	Very good	Northern red oak, red maple, sugar maple, white ash.
Pin oak, American sycamore, red maple.	Eastern white pine, white spruce.	Excellent for pin oak; poor for other species.	Red maple.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, European larch, yellow-poplar, black walnut, Norway spruce.	Excellent	Yellow-poplar, northern red oak, black walnut, sugar maple, white ash.
Northern red oak, eastern white pine, black oak, Virginia pine.	Eastern white pine, European larch, Norway spruce, red pine, Virginia pine.	Good	Northern red oak, eastern white pine, Virginia pine, black oak.
Black oak, chestnut oak, Virginia pine, northern red oak.	Eastern white pine, Virginia pine.	Fair	Northern red oak, black oak, Virginia pine.
Northern red oak, yellow-poplar, white ash, red maple, sugar maple.	Eastern white pine, European larch, white spruce, yellow-poplar, Norway spruce.	Very good	Northern red oak, white ash, red maple, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, white ash, red maple, sugar maple.	Eastern white pine, European larch, white spruce, yellow-poplar, Norway spruce.	Very good	Northern red oak, white ash, red maple, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, white ash, sugar maple, red maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, white spruce.	Good	Northern red oak, red maple, white ash, yellow-poplar, sugar maple.
Northern red oak, yellow-poplar, white ash, sugar maple, red maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, white spruce.	Good	Northern red oak, red maple, white ash, yellow-poplar, sugar maple.
Northern red oak, yellow-poplar, white ash, sugar maple, red maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, white spruce.	Good	Northern red oak, red maple, white ash, yellow-poplar, sugar maple.

TABLE 3.—*Soil interpretations*

Soil series and map symbols	Management concerns					
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard
				Conifers	Hardwoods	
Cavode: CdA, CdB	Slight	Moderate	Slight	Severe	Severe	Moderate
Chagrin: Ch	Slight	Slight	Slight	Severe	Moderate	Slight
Clarksburg: CkA, CkB	Slight	Slight	Moderate	Severe	Moderate	Slight
Clymer: ClB, ClC, CvB	Slight	Slight	Slight	Severe	Moderate	Slight
CvD	Slight	Moderate	Slight	Severe	Moderate	Slight
Dunning: Du	Slight	Severe	Severe	Severe	Severe	Severe
Edom: EdB, EdC	Slight	Slight	Slight	Severe	Moderate	Slight
EdD	Slight	Moderate	Slight	Severe	Moderate	Slight
Ernest: ErB, ErC, EvB	Slight	Moderate	Slight	Severe	Moderate	Slight
ErD, EvD	Moderate	Moderate	Slight	Severe	Moderate	Slight
Gilpin: GlB, GlC	Slight	Slight	Slight	Slight	Moderate	Slight
GlD	Moderate	Moderate	Slight	Slight	Moderate	Slight
Hagerstown: HaA, HaB, HaC, HcB, HcC	Slight	Slight	Slight	Severe	Severe	Slight
HcD	Moderate	Moderate	Slight	Severe	Severe	Slight

for woodland—Continued

Species suitable—		Site quality	
For favoring in existing stands	For planting or seeding	Rating	Species
Northern red oak, yellow-poplar, eastern white pine, sugar maple, white ash, red maple.	Eastern white pine, yellow-poplar, European larch, white spruce.	Very good	Northern red oak, yellow-poplar, white ash, eastern white pine, sugar maple.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Black walnut, yellow-poplar, eastern white pine, European larch, Norway spruce.	Excellent	Yellow-poplar, northern red oak, black walnut, sugar maple, white ash.
Northern red oak, yellow-poplar, white ash, sugar maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce.	Very good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, eastern white pine, yellow-poplar, black oak, white ash, sugar maple.	Eastern white pine, European larch, red pine, Norway spruce, yellow-poplar, Virginia pine.	Very good	Northern red oak, black oak, white ash, sugar maple, yellow-poplar.
Northern red oak, eastern white pine, yellow-poplar, black oak, white ash, sugar maple.	Eastern white pine, European larch, red pine, Norway spruce, yellow-poplar, Virginia pine.	Very good	Northern red oak, black oak, white ash, sugar maple, yellow-poplar.
Pin oak, American sycamore, red maple.	Eastern white pine, white spruce.	Excellent for pin oak; poor for other species.	Red maple.
Yellow-poplar, northern red oak, white ash, sugar maple.	Yellow-poplar, European larch, Norway spruce, red pine, Virginia pine, eastern white pine.	Very good	Northern red oak, yellow-poplar, white ash, sugar maple.
Yellow-poplar, northern red oak, white ash, sugar maple.	Yellow-poplar, European larch, Norway spruce, red pine, Virginia pine, eastern white pine.	Very good	Northern red oak, yellow-poplar, white ash, sugar maple.
Northern red oak, sugar maple, yellow-poplar, white ash.	Eastern white pine, white spruce, Norway spruce, European larch, yellow-poplar.	Very good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, sugar maple, yellow-poplar, white ash.	Eastern white pine, white spruce, Norway spruce, European larch, yellow-poplar.	Very good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, white ash, eastern white pine, Virginia pine, sugar maple.	Eastern white pine, yellow-poplar, Virginia pine, European larch, Norway spruce, red pine.	Very good	Northern red oak, white ash, yellow-poplar, eastern white pine, sugar maple.
Northern red oak, yellow-poplar, white ash, eastern white pine, Virginia pine, sugar maple.	Eastern white pine, yellow-poplar, Virginia pine, European larch, Norway spruce, red pine.	Very good	Northern red oak, white ash, yellow-poplar, eastern white pine, sugar maple.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, black walnut, yellow-poplar, European larch, Norway spruce.	Excellent	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, black walnut, yellow-poplar, European larch, Norway spruce.	Excellent	Northern red oak, white ash, sugar maple, yellow-poplar.

TABLE 3.—*Soil interpretations*

Soil series and map symbols	Management concerns					
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard
				Conifers	Hardwoods	
Hazleton:						
HhB HhC	Slight	Slight	Moderate	Moderate	Slight	Slight
HhD, HSB, HSD	Slight	Moderate	Severe	Moderate	Slight	Slight
HTF Interpretations for HTF apply to Dekalb part of unit as well as to Hazelton part.	Moderate	Severe	Severe	Slight	Slight	Slight
Hublersburg:						
HuA, HuB, HuC	Slight	Slight	Slight	Severe	Severe	Slight
HuD	Moderate	Moderate	Slight	Severe	Severe	Slight
Laidig:						
LaB, LaC	Slight	Slight	Slight	Moderate	Slight	Slight
LaD, LcB, LcD	Slight	Moderate	Slight	Moderate	Slight	Slight
LDF	Moderate	Severe	Slight	Moderate	Slight	Slight
Leck Kill:						
LkB, LkC, LlB	Slight	Slight	Slight	Moderate	Slight	Slight
LkD, LlD	Slight	Moderate	Slight	Moderate	Slight	Slight
LMF Interpretations for LMF apply to Calvin part of unit as well as to Leck Kill part.	Moderate	Severe	Moderate	Moderate	Slight	Slight
Leetonia: LtB	Slight	Moderate	Severe	Slight	Slight	Slight
Leetonia variant: LvB, LvC	Slight	Moderate	Severe	Slight	Slight	Slight
Lindside: Lx	Slight	Slight	Slight	Severe	Severe	Slight
Markes: MaB	Slight	Severe	Severe	Severe	Severe	Moderate
Meckesville:						
MeB MeC, MkB	Slight	Slight	Slight	Severe	Moderate	Slight

for woodland—Continued

Species suitable—		Site quality	
For favoring in existing stands	For planting or seeding	Rating	Species
Northern red oak, yellow-poplar, sugar maple, white ash, eastern white pine, red maple.	Eastern white pine, European larch, Norway spruce, yellow-poplar.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, sugar maple, white ash, eastern white pine, red maple.	Eastern white pine, European larch, Norway spruce, yellow-poplar.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Black oak, chestnut oak, Virginia pine, pitch pine, eastern white pine.	Virginia pine, eastern white pine, red pine.	Fair	Black oak, eastern white pine, Virginia pine.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, yellow-poplar, black walnut, European larch, Norway spruce, red pine.	Very good	Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, yellow-poplar, black walnut, European larch, Norway spruce, red pine.	Very good	Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.
Northern red oak, yellow-poplar, sugar maple, white ash.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, sugar maple, white ash.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, sugar maple, white ash.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, black oak, Virginia pine, eastern white pine, white ash, sugar maple.	Eastern white pine, Virginia pine, European larch, Norway spruce, red pine.	Good	Northern red oak, Virginia pine, eastern white pine, black oak, white ash, sugar maple.
Northern red oak, black oak, Virginia pine, eastern white pine, white ash, sugar maple.	Eastern white pine, Virginia pine, European larch, Norway spruce, red pine.	Good	Northern red oak, Virginia pine, eastern white pine, black oak, white ash, sugar maple.
Northern red oak, Virginia pine, eastern white pine, black oak, white ash, sugar maple.	Eastern white pine, Virginia pine, European larch, Norway spruce, red pine.	Good	Northern red oak, Virginia pine, eastern white pine, black oak, white ash, sugar maple.
Chestnut oak, pitch pine, black oak.	Pitch pine, Virginia pine	Poor	Black oak, chestnut oak, pitch pine.
Eastern white pine, chestnut oak, northern red oak, black oak.	Eastern white pine, Virginia pine.	Fair	Black oak, chestnut oak, pitch pine.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, yellow-poplar, European larch, black walnut, Norway spruce.	Excellent	Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.
Pin oak, red maple, American sycamore.	Eastern white pine, white spruce.	Fair	Red maple.
Northern red oak, eastern white pine, yellow-poplar, white ash, sugar maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine.	Very good	Northern red oak, yellow-poplar, eastern white pine, white ash, sugar maple.

TABLE 3.—*Soil interpretations*

Soil series and map symbols	Management concerns					
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard
				Conifers	Hardwoods	
Meckesville: Cont. MkD	Moderate	Moderate	Slight	Severe	Moderate	Slight
Melvin: Mm	Slight	Severe	Severe	Severe	Severe	Moderate
Millheim: MnB, MnC	Slight	Slight	Slight	Severe	Moderate	Slight
MnD	Slight	Moderate	Slight	Severe	Moderate	Slight
Monongahela: MoB	Slight	Moderate	Slight	Moderate	Slight	Slight
Morrison: MrB, MrC, MsB	Slight	Slight	Slight	Moderate	Slight	Slight
MrD, MsD	Slight	Moderate	Slight	Moderate	Slight	Slight
MTF	Moderate	Severe	Slight	Moderate	Slight	Slight
Murrill: MuA, MuB, MuC, MvB	Slight	Slight	Slight	Moderate	Slight	Slight
MuD, MvD	Slight	Moderate	Slight	Moderate	Slight	Slight
Nolin: No	Slight	Slight	Slight	Severe	Moderate	Slight
Opequon: OhB For Hagerstown part, see Hagerstown series, HcB.	Slight	Slight	Severe	Severe	Moderate	Moderate
OhC For Hagerstown part, see Hagerstown series, HcC.	Moderate	Moderate	Severe	Severe	Moderate	Moderate
OhD For Hagerstown part, see Hagerstown series, HcD.	Severe	Severe	Severe	Severe	Moderate	Moderate

for woodland—Continued

Species suitable—		Site quality	
For favoring in existing stands	For planting or seeding	Rating	Species
Northern red oak, eastern white pine, yellow-poplar, white ash, sugar maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine.	Very good	Northern red oak, yellow-poplar, eastern white pine, white ash, sugar maple.
Pin oak, red maple, American sycamore, eastern white pine, eastern hemlock.	Eastern white pine, white spruce.	Excellent for pin oak; fair for other species.	Red maple, eastern white pine.
Northern red oak, eastern white pine, yellow-poplar, sugar maple, white ash.	Eastern white pine, yellow-poplar, Virginia pine, European larch, Norway spruce, red pine.	Very good	Northern red oak, yellow-poplar, eastern white pine, white ash, sugar maple.
Northern red oak, eastern white pine, yellow-poplar, sugar maple, white ash.	Eastern white pine, yellow-poplar, Virginia pine, European larch, Norway spruce, red pine.	Very good	Northern red oak, yellow-poplar, eastern white pine, white ash, sugar maple.
Northern red oak, yellow-poplar, eastern white pine, Virginia pine, white ash, sugar maple.	Eastern white pine, yellow-poplar, Virginia pine, European larch, Norway spruce, red pine.	Good	Northern red oak, white ash, sugar maple, yellow-poplar, eastern white pine.
Black oak, northern red oak, Virginia pine, white ash, sugar maple, yellow-poplar.	Eastern white pine, European larch, Norway spruce, Virginia pine, yellow-poplar, red pine.	Good	Northern red oak, yellow-poplar, black oak, white ash, sugar maple.
Black oak, northern red oak, Virginia pine, white ash, sugar maple, yellow-poplar.	Eastern white pine, European larch, Norway spruce, Virginia pine, yellow-poplar, red pine.	Good	Northern red oak, yellow-poplar, black oak, white ash, sugar maple.
Black oak, northern red oak, Virginia pine, white ash, sugar maple, yellow-poplar.	Eastern white pine, European larch, Norway spruce, Virginia pine, yellow-poplar, red pine.	Good	Northern red oak, yellow-poplar, black oak, white ash, sugar maple.
Northern red oak, yellow-poplar, white ash, sugar maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine, Virginia pine.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, white ash, sugar maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce, red pine, Virginia pine.	Good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, yellow-poplar, black walnut, European larch, Norway spruce.	Excellent	Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.
Northern red oak, black oak, chestnut oak, Virginia pine, eastern white pine.	Eastern white pine, Virginia pine.	Good	Northern red oak, black oak, chestnut oak, Virginia pine.
Northern red oak, black oak, chestnut oak, Virginia pine, eastern white pine.	Eastern white pine, Virginia pine.	Good	Northern red oak, black oak, chestnut oak, Virginia pine.
Northern red oak, black oak, chestnut oak, Virginia pine, eastern white pine.	Eastern white pine, Virginia pine.	Good	Northern red oak, black oak, chestnut oak, Virginia pine.

TABLE 3.—*Soil interpretations*

Soil series and map symbols	Management concerns					
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard
				Conifers	Hardwoods	
Opequon: ORF:						
Opequon part	Severe	Severe	Severe	Severe	Moderate	Moderate
Hagerstown part	Severe	Severe	Slight	Severe	Severe	Slight
OxB	Slight	Slight	Severe	Severe	Moderate	Moderate
Rock outcrop part not suited to growing trees commercially.						
OxD	Severe	Severe	Severe	Severe	Moderate	Moderate
Rock outcrop part not suited to growing trees commercially.						
Philo: Ph	Slight	Slight	Slight	Severe	Moderate	Slight
Philo: Pk:						
Philo part	Slight	Slight	Slight	Severe	Moderate	Slight
Atkins part	Severe	Severe	Severe	Severe	Severe	Moderate
Pope: Po	Slight	Slight	Slight	Severe	Moderate	Slight
Purdy: Pu	Slight	Severe	Severe	Moderate	Moderate	Moderate
Rayne: RaB	Slight	Slight	Slight	Severe	Moderate	Slight
Rubble land: Ru. Not suited to growing trees commercially.						
Strip mines: Sm. Properties too variable to be rated.						
Tyler: Ty	Slight	Moderate	Moderate	Severe	Severe	Moderate
Ungers: UmB, UmC, UnB	Slight	Slight	Slight	Moderate	Slight	Slight
UmD, UnD	Slight	Moderate	Slight	Moderate	Slight	Slight
Urban land: URB. Not suited to growing trees commercially. For Hagerstown part, see Hagerstown series, HaB.						

for woodland—Continued

Species suitable—		Site quality	
For favoring in existing stands	For planting or seeding	Rating	Species
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, Virginia pine.	Good	Northern red oak, black oak, chestnut oak, Virginia pine.
Northern red oak, yellow-poplar, black walnut, white ash, sugar maple.	Eastern white pine, black walnut, yellow-poplar, European larch.	Excellent	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, black oak, chestnut oak, Virginia pine, eastern white pine.	Virginia pine, eastern white pine.	Good	Northern red oak, black oak, chestnut oak, Virginia pine.
Northern red oak, black oak, chestnut oak, Virginia pine, eastern white pine.	Virginia pine, eastern white pine.	Good	Northern red oak, black oak, chestnut oak, Virginia pine.
Sugar maple, yellow-poplar, black walnut, northern red oak, eastern white pine, white ash.	Yellow-poplar, black walnut, European larch, Norway spruce, red pine, eastern white pine.	Very good	Northern red oak, white ash, yellow-poplar, sugar maple.
Yellow-poplar, black walnut, northern red oak, white ash, sugar maple, eastern white pine.	Yellow-poplar, black walnut, European larch, Norway spruce, red pine, eastern white pine.	Very good	Northern red oak, white ash, yellow-poplar, sugar maple.
Pin oak, American sycamore, red maple.	Eastern white pine, white spruce.	Excellent for pin oak; fair for other species.	Red maple.
Yellow-poplar, black walnut, northern red oak, white ash, sugar maple, eastern white pine.	Yellow-poplar, black walnut, European larch, Norway spruce, red pine, eastern white pine.	Excellent	Yellow-poplar, black walnut, northern red oak, eastern white pine, sugar maple.
Pin oak, red maple, American sycamore.	Eastern white pine, white spruce.	Fair	Red maple.
Yellow-poplar, northern red oak, white ash, sugar maple.	Yellow-poplar, European larch, Norway spruce, eastern white pine.	Very good	Northern red oak, yellow-poplar, white ash, sugar maple.
Northern red oak, yellow-poplar, white ash, black oak, sugar maple.	Eastern white pine, yellow-poplar, European larch, Norway spruce.	Very good	Northern red oak, white ash, yellow-poplar, sugar maple.
Northern red oak, Virginia pine, eastern white pine, white oak.	Eastern white pine, Virginia pine, European larch.	Good	Northern red oak, eastern white pine, Virginia pine.
Northern red oak, Virginia pine, eastern white pine, white oak.	Eastern white pine, Virginia pine, European larch.	Good	Northern red oak, eastern white pine, Virginia pine.

TABLE 3.—*Soil interpretations*

Soil series and map symbols	Management concerns					
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard
				Conifers	Hardwoods	
Vanderlip: VaC	Slight	Moderate	Severe	Slight	Slight	Slight
Weikert:						
WeC	Slight	Slight	Severe	Slight	Slight	Slight
WeD	Slight	Moderate	Severe	Slight	Slight	Slight
Wharton:						
WhA, WhB	Slight	Slight	Slight	Severe	Moderate	Slight
WhC	Moderate	Slight	Slight	Severe	Moderate	Slight
Wyoming: WyA	Slight	Slight	Severe	Moderate	Slight	Slight

Fishing in Centre County is excellent. Brook, rainbow, and brown trout are found in 275 miles of unpolluted streams. Warm-water fishing thrives in numerous ponds, lakes, and reservoirs throughout the county.

Nongame birds and animals are numerous. Many of them, particularly the songbirds, are important because of their esthetic value, and they eat insects and seeds of harmful weeds. Many of the songbirds inhabit residential areas, where birdwatching is a popular pastime.

Suitability of the soils for wildlife

Soil suitability is one of the important factors necessary for the production of desired populations of wildlife. Other important factors are present land use and existing wildlife populations, which require onsite investigation for their evaluation. Soil interpretations should be used along with other types of information in a total study of resource suitability of an area for the production of wildlife.

Every species of wildlife requires certain kinds of soil, vegetation, and water areas for food and cover. Proper manipulation of soil, water, and plants to produce suitable habitat is the most effective means of maintaining and improving wildlife populations. Through knowledge of the properties of soils, it is possible to predict their suitability to produce the habitat elements essential for wildlife.

In table 4, the soils are rated according to their suitability to produce essential elements of wildlife habitat and kinds of habitat (*1*). Each rating reflects only the characteristics of the individual, unmodified soil. A rating of *good* indicates that habitat generally is easily created, improved or maintained. There are few limitations in management and satisfactory results can be expected. A rating of *fair* indicates that habitat generally can be created, improved, or maintained. Moderate soil limitations affect management. Moderate intensity of management and frequent attention is required in some areas for satisfactory results. A rating of *poor* indicates that habitat generally can be created, improved, or maintained. Severe soil limitations affect management and in places maintenance is difficult and expensive. Results are questionable. A rating of *very poor* indicates that under prevailing conditions, habitat is impractical to create, improve, or maintain. Unsatisfactory results are probable.

It should be noted that the ratings indicate only potential suitability for wildlife habitat. Changes in land use may modify the local environment and the species of wildlife which inhabit the area. Also, the capability of wildlife to move from place to place and to utilize more than one kind of habitat are not considered in making the ratings.

The elements of wildlife habitat rated in table 4 are described in the following paragraphs:

Grain and seed crops are domestic grains and seed-producing annual plants, such as corn, wheat, and millet.

Grasses and legumes are domestic perennial grasses and herbaceous legumes, such as timothy, alfalfa, and reed canarygrass.

Wild herbaceous plants are wild grasses and weeds that furnish food and cover for wildlife. Examples are goldenrod and pokeweed.

Hardwood trees are deciduous trees, shrubs, and vines that produce fruit, nuts, buds, and foliage and

for woodland—Continued

Species suitable—		Site quality	
For favoring in existing stands	For planting or seeding	Rating	Species
Eastern white pine, northern red oak, black oak, Virginia pine.	Eastern white pine, Virginia pine, European larch, red pine, Norway spruce.	Good	Northern red oak, black oak, Virginia pine.
Virginia pine, chestnut oak, black oak, northern red oak.	Virginia pine, eastern white pine, red pine.	Fair	Northern red oak, black oak, chestnut oak, Virginia pine.
Virginia pine, chestnut oak, black oak, northern red oak.	Virginia pine, eastern white pine, red pine.	Fair	Northern red oak, black oak, chestnut oak, Virginia pine.
Northern red oak, eastern white pine, yellow-poplar, sugar maple, white ash, black walnut.	Eastern white pine, yellow-poplar, European larch, Norway spruce, black walnut.	Very good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, eastern white pine, yellow-poplar, sugar maple, white ash, black walnut.	Eastern white pine, yellow-poplar, European larch, Norway spruce, black walnut.	Very good	Northern red oak, white ash, sugar maple, yellow-poplar.
Northern red oak, black oak, red maple, eastern white pine.	Eastern white pine, Virginia pine, red pine.	Fair	Northern red pine, eastern white pine, black oak, red maple.

are used by wildlife for both food and cover. Examples are oak, dogwood, grape, and briar.

Coniferous plants are cone-bearing trees and shrubs, such as pine, cedar, and yew.

Wetland plants are wild herbaceous plants that are commonly associated with moist to wet areas, exclusive of submerged and floating aquatic plants. Examples are such plants as smartweed, bullrushes, reed canarygrass, and cattail.

Shallow water areas are areas of surface water not more than 5 feet deep. Such areas may be natural or created by low dikes, level ditches, and water control devices on marshy streams.

The kinds of wildlife habitat rated in table 4 are described in the following paragraphs:

Open-land wildlife inhabits cropland, pasture, meadow, and areas overgrown with grasses, herbs, vines, or shrubby plants. Such areas provide habitat for quail, pheasants, doves, woodcock, cottontail rabbits, meadowlarks, killdeer, and field sparrows.

Woodland wildlife inhabits areas of either hardwood or coniferous trees and shrubs, or combinations of both. Such areas provide habitat for grouse, turkeys, deer, squirrels, wood thrushes, warblers, and vireos.

Wetland wildlife inhabits marshes, swamps, and open water areas. Such areas provide habitat for ducks, geese, rails, snipe, muskrats, and beaver.

Town and Country Planning

This section provides information on properties of the soils and their effect on town and country planning. Community planners, developers, and individual landowners can use this information to help determine the most suitable use for a particular area. Other useful information can be found on the soil map and in other parts of the survey, particularly in the sections "Descriptions of the Soils" and "Engineering Uses of the Soils." Although the soil map and the data in this section serve as guides and can eliminate some sites from further consideration, they do not supplant direct detailed onsite investigation of planned development. Not considered in rating the soils are location of areas in relation to established business centers or transportation lines and other economic factors that are important in determining the ultimate use of an area.

Soil limitations for specified uses in town and country planning are given in table 5. The degrees of limitations are indicated by the ratings of slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or, in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Following are explanations of the columns in table 5.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between the depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout

TABLE 4.—*Suitability of the soils*

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Albrights:				
AbB	Fair	Good	Good	Good
AbC	Fair	Good	Good	Good
AcB	Very poor	Poor	Good	Good
AcC	Very poor	Poor	Good	Good
Allegheny: AlB	Good	Good	Good	Good
Andover:				
AnB	Poor	Fair	Fair	Fair
AnC	Poor	Fair	Fair	Fair
AoB	Very poor	Poor	Fair	Fair
AoC	Very poor	Poor	Fair	Fair
Armagh:				
ArA	Poor	Fair	Fair	Fair
ArB	Poor	Fair	Fair	Fair
Atkins: At	Poor	Fair	Fair	Fair
Basher: Ba	Good	Good	Good	Good
Berks:				
BkB	Poor	Fair	Fair	Very poor
BkC, BkD	Poor	Fair	Fair	Very poor
BlD	Very poor	Poor	Fair	Very poor
BMF. Interpretations for BMF apply to Weikert part of unit as well as to Berks part.	Very poor	Very poor	Poor	Very poor
Brinkerton:				
BrA	Poor	Fair	Good	Fair
BrB	Poor	Fair	Good	Fair
BrC	Poor	Fair	Good	Fair
BsB	Very poor	Poor	Good	Fair
Buchanan:				
BtB	Fair	Good	Good	Good
BuB	Fair	Good	Good	Good
BuC	Fair	Good	Good	Good
BxB	Very poor	Very poor	Good	Good
BxD	Very poor	Very poor	Good	Good
Carlisle: CA	Very poor	Very poor	Very poor	Very poor
Cavode:				
CdA	Fair	Good	Good	Good
CdB	Fair	Good	Good	Good
Chagrin: Ch	Good	Good	Good	Good
Clarksburg:				
CkA	Fair	Good	Good	Good
CkB	Fair	Good	Good	Good
Clymer:				
ClB	Fair	Good	Good	Good
ClC	Fair	Good	Good	Good
CvB, CvD	Very poor	Poor	Good	Good
Dunning: Du	Very poor	Poor	Poor	Poor
Edom:				
EdB	Good	Good	Good	Good
EdC	Fair	Good	Good	Good
EdD	Poor	Fair	Good	Good

for wildlife habitat

Potential for habitat elements—Continued			Potential for kinds of habitat—		
Coniferous plants	Wetland plants	Shallow water areas	Open-land	Woodland	Wetland
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Fair	Good	Fair	Fair	Fair	Fair.
Good	Poor	Poor	Good	Good	Poor.
Very poor	Poor	Very poor	Poor	Poor	Very poor.
Very poor	Very poor	Very poor	Poor	Poor	Very poor.
Very poor	Very poor	Very poor	Poor	Poor	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Poor	Fair	Very poor.
Good	Very poor	Very poor	Poor	Fair	Very poor.
Very poor	Good	Good	Very poor	Very poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.

TABLE 4.—*Suitability of the soils*

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Ernest:				
ErB	Fair	Good	Good	Good
ErC	Fair	Good	Good	Good
ErD	Poor	Fair	Good	Good
EvB	Very poor	Poor	Good	Good
EvD	Very poor	Poor	Good	Good
Gilpin:				
GlB	Fair	Good	Good	Fair
GlC	Fair	Good	Good	Fair
GlD	Poor	Fair	Good	Fair
Hagerstown:				
HaA	Good	Good	Good	Good
HaB	Fair	Good	Good	Good
HaC	Fair	Good	Good	Good
HcB	Fair	Good	Fair	Good
HcC	Fair	Good	Fair	Good
HcD	Poor	Fair	Fair	Good
Hazleton:				
HhB	Fair	Good	Good	Fair
HhC	Fair	Good	Good	Fair
HhD	Poor	Fair	Good	Fair
HSB	Very poor	Very poor	Good	Fair
HSD	Very poor	Very poor	Good	Fair
Hazleton:				
HTF:				
Hazleton part	Very poor	Very poor	Good	Fair
Dekalb part	Very poor	Very poor	Fair	Poor
Hublersburg:				
HuA	Good	Good	Good	Good
HuB	Fair	Good	Good	Good
HuC	Fair	Good	Good	Good
HuD	Poor	Fair	Good	Good
Laidig:				
LaB	Fair	Good	Good	Fair
LaC	Fair	Good	Good	Fair
LaD	Poor	Fair	Good	Fair
LcB	Very poor	Very poor	Good	Fair
LcD, LDF	Very poor	Very poor	Good	Fair
Leck Kill:				
LkB	Fair	Good	Good	Good
LkC	Fair	Good	Good	Good
LkD	Poor	Fair	Good	Good
LlB	Very poor	Poor	Good	Good
LlD	Very poor	Poor	Good	Good
LMF:				
Leck Kill part	Very poor	Very poor	Good	Good
Calvin part	Very poor	Very poor	Good	Fair
Leetonia: LtB	Very poor	Very poor	Poor	Very poor
Leetonia variant:				
LvB	Very poor	Poor	Poor	Very poor
LvC	Very poor	Very poor	Poor	Very poor
Lindside: Lx	Good	Good	Good	Good
Markes: MaB	Poor	Fair	Fair	Fair
Meckesville:				
MeB	Fair	Good	Good	Good
MeC	Fair	Good	Good	Good
MkB	Very poor	Poor	Good	Good
MkD	Very poor	Poor	Good	Good

for wildlife habitat—Continued

Potential for habitat elements—Continued			Potential for kinds of habitat—		
Coniferous plants	Wetland plants	Shallow water areas	Open-land	Woodland	Wetland
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.

TABLE 4.—*Suitability of the soils*

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Melvin: Mm	Poor	Fair	Fair	Fair
Millheim:				
MnB	Good	Good	Good	Good
MnC	Fair	Good	Good	Good
MnD	Poor	Fair	Good	Good
Monongahela: MoB	Fair	Good	Good	Good
Morrison:				
MrB	Good	Good	Good	Good
MrC	Fair	Good	Good	Good
MrD	Poor	Fair	Good	Good
MsB	Very poor	Poor	Good	Good
MsD, MTF	Very poor	Poor	Good	Good
Murrill:				
MuA	Good	Good	Good	Good
MuB	Fair	Good	Good	Good
MuC	Fair	Good	Good	Good
MuD	Poor	Fair	Good	Good
MvB, MvD	Very poor	Poor	Good	Good
Nolin: No	Good	Good	Good	Good
Opequon				
OhB	Poor	Poor	Fair	Poor
For Hagerstown part, see Hagerstown series, HcB.				
OhC OhD	Poor	Poor	Fair	Poor
For Hagerstown parts of OhC and OhD, see Hagerstown series, HcC and HcD, respectively.				
ORF:				
Opequon part	Very poor	Poor	Fair	Poor
Hagerstown part	Very poor	Poor	Good	Good
OxB	Poor	Poor	Fair	Poor
Rock outcrop part is not rated.				
OxD	Poor	Poor	Fair	Poor
Rock outcrop part is not rated.				
Philo:				
Ph	Good	Good	Good	Good
Pk:				
Philo part	Very poor	Poor	Good	Good
Atkins part	Very poor	Poor	Fair	Fair
Pope: Po	Good	Good	Good	Good
Purdy: Pu	Poor	Fair	Fair	Fair
Rayne: RaB	Fair	Good	Good	Good
Rubble land: Ru	Very poor	Very poor	Very poor	Very poor
Strip Mines: Sm. Too variable to rate.				
Tyler: Ty	Fair	Good	Good	Good

for wildlife habitat—Continued

Potential for habitat elements—Continued			Potential for kinds of habitat—		
Coniferous plants	Wetland plants	Shallow water areas	Open-land	Woodland	Wetland
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Poor	Poor	Good	Poor.
Fair	Good	Fair	Poor	Fair	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Good	Fair	Fair	Good	Good	Fair.

TABLE 4.—*Suitability of the soils*

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Ungers:				
UmB	Fair	Good	Good	Good
UmC	Fair	Good	Good	Good
UmD	Poor	Fair	Good	Good
UnB	Very poor	Poor	Good	Good
UnD	Very poor	Poor	Good	Good
Urban land: URB. Urban land series too variable to rate; requires onsite investigation. For Hagerstown part, see Hagerstown series, HaB.				
Vanderlip: VaC	Poor	Fair	Good	Fair
Weikert: WeC, WeD	Very poor	Poor	Poor	Very poor
Wharton:				
WhA	Good	Good	Good	Good
WhB	Fair	Good	Good	Good
WhC	Poor	Fair	Good	Good
Wyoming: WyA	Poor	Fair	Fair	Poor

and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rock or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope, and if the floor needs to be leveled, depth to and condition of bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Dwellings with basements as rated in table 5 are for homesites or other buildings of three stories or less in height that have no more than an 8 foot excavation for basements. Buildings with foundation loads in excess of those equal to three story dwellings and with more than an 8-foot excavation for basements are excluded from the ratings. Considered in rating the soils are the depth to water table, shrink-swell potential, the depth to and the kind of bedrock, soil texture, the percent of slope, potential frost action, and the hazard of flooding.

For lawns and landscaping, it is assumed that enough lime and fertilizer are used for good growth of lawn grasses and ornamental plants. Suitable soil material is needed in sufficient quantities so desirable trees and other plants can survive and grow well. Among the important soil properties for lawns and landscaping are depth to bedrock or layers that restrict water and roots, texture, slope, depth to water table, and the presence of stones or rock fragments.

Local roads and streets, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are the load supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rock fragments, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Sanitary landfill is a method of disposing of refuse. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable

for wildlife habitat—Continued

Potential for habitat elements—Continued			Potential for kinds of habitat—		
Coniferous plants	Wetland plants	Shallow water areas	Open-land	Woodland	Wetland
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Very poor	Very poor	Fair	Poor	Very poor.

and easy to excavate. Unless otherwise stated, the ratings in table 5 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are much deeper than that. Even though reliable predictions can be made to a depth of 10 or 15 feet for some soils, every site should be investigated before it is selected.

Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 6 the soils of Centre County are rated according to limitations that affect their use for camp areas, service buildings and buildings without basements, paths and trails, picnic areas, playgrounds, and golf fairways.

In table 6 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have gentle slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry.

Service buildings and dwellings, as rated in table 6, are without basements, are not more than three stories high, and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for service buildings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, content of stones, and outcrops of rock.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rock fragments or stones on the surface.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes or stoniness that greatly increases cost of leveling sites or of building access roads.

Playgrounds are used intensively for baseball, foot-

TABLE 5.—*Soil limitations for*

[An asterisk in the first column indicates that at least one mapping unit is made of two or more kinds of soil. The soils in such map- referring to other

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Albrights:		
AbB	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope; small stones
AbC	Severe: seasonal high water table; moderately slow permeability.	Severe: slope
AcB	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope; small and large stones.
AcC	Severe: seasonal high water table; moderately slow permeability.	Severe: slope
Allegheny: AlB	Slight	Moderate: slope; moderate permeability.
Andover:		
AnB	Severe: high water table; slow permeability.	Moderate: slope; small stones; inflow hazard.
AnC, AoC	Severe: high water table; slow permeability.	Severe: slope
AoB	Severe: high water table; slow permeability.	Moderate: slope; small and large stones; inflow hazard.
Armagh:		
ArA	Severe: high water table; slow permeability.	Moderate: depth to bedrock; inflow hazard.
ArB	Severe: high water table; slow permeability.	Moderate: slope; depth to bedrock; inflow hazard.
Atkins: At	Severe: high water table; flooding; moderately slow to slow permeability.	Severe: flooding
Basher: Ba	Severe: flooding; seasonal high water table.	Severe: flooding; permeable substratum.
Berks:		
BkB	Severe: depth to bedrock	Severe: depth to bedrock; moderately rapid permeability; small stones.
BkC	Severe: depth to bedrock	Severe: slope; depth to bedrock; moderately rapid permeability; small stones.
BkD, BlD	Severe: slope; depth to bedrock	Severe: slope; depth to bedrock; moderately rapid permeability; small stones.
BMF Interpretations for BMF apply to Weikert part of unit as well as to Berks part.	Severe: slope; depth to bedrock	Severe: slope; depth to bedrock; moderately rapid permeability; small stones.
Brinkerton:		
BrA	Severe: high water table; slow permeability.	Slight: inflow hazard
BrB	Severe: high water table; slow permeability.	Moderate: slope; inflow hazard
BrC	Severe: high water table; slow permeability.	Severe: slope
BsB	Severe: high water table; slow permeability.	Moderate: slope; large stones; inflow hazard.

town and country planning

ping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for series as indicated]

Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Moderate: seasonal high water table.	Slight	Moderate: frost action	Severe: seasonal high water table.
Moderate: slope; seasonal high water table.	Moderate: slope	Moderate: slope; frost action.	Severe: seasonal high water table.
Moderate: large stones; seasonal high water table.	Moderate: large stones	Moderate: frost action	Severe: seasonal high water table.
Moderate: slope; large stones; seasonal high water table.	Moderate: slope; large stones.	Moderate: slope; frost action.	Severe: seasonal high water table.
Slight	Slight	Severe: frost action	Slight.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table; depth to bedrock.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table; depth to bedrock.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table; frost action.	Severe: flooding; high water table.
Severe: flooding	Moderate: flooding	Moderate: flooding; frost action.	Severe: flooding; permeable substratum; seasonal high water table.
Moderate: depth to bedrock	Moderate: depth to bedrock	Slight	Severe: depth to bedrock; moderately rapid permeability.
Moderate: slope; depth to bedrock.	Moderate: slope; depth to bedrock.	Moderate: slope	Severe: depth to bedrock; moderately rapid permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: depth to bedrock; moderately rapid permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; depth to bedrock; moderately rapid permeability.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table.

TABLE 5.—*Soil limitations for*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Buchanan: BtB, BuB	Severe: seasonal high water table; slow permeability.	Moderate: slope; small stones
BuC	Severe: seasonal high water table; slow permeability.	Severe: slope
BxB	Severe: seasonal high water table; slow permeability; large stones.	Severe: large stones
BxD	Severe: slope; seasonal high water table; slow permeability; large stones.	Severe: slope; large stones
Carlisle: CA	Severe: high water table; flooding; organic material.	Severe: organic material; flooding; moderately rapid permeability.
Cavode: CdA	Severe: seasonal high water table; slow permeability.	Moderate: depth to bedrock; inflow hazard.
CdB	Severe: seasonal high water table; slow permeability.	Moderate: slope; depth to bedrock; inflow hazard.
Chagrin: Ch	Severe: flooding	Severe: flooding; permeable substratum.
Clarksburg: CkA	Severe: seasonal high water table; slow permeability.	Slight
CkB	Severe: seasonal high water table; slow permeability.	Moderate: slope
Clymer: ClB	Slight	Severe: moderately rapid permeability.
ClC	Moderate: slope	Severe: slope; moderately rapid permeability.
CvB	Moderate: large stones	Severe: moderately rapid permeability.
CvD	Severe: slope	Severe: slope; moderately rapid permeability.
Dunning: Du	Severe: flooding; slow permeability; high water table.	Severe: flooding
Edom: EdB	Moderate [2]: depth to bedrock	Moderate [2]: slope; moderate permeability; depth to bedrock; small stones.
EdC	Moderate [2]: slope; depth to bedrock	Severe [2]: slope
EdD	Severe [2]: slope	Severe [2]: slope
Ernest: ErB	Severe: seasonal high water table; moderately slow and slow permeability.	Moderate: slope
ErC	Severe: seasonal high water table; moderately slow and slow permeability.	Severe: slope

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Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Moderate: seasonal high water table.	Slight	Moderate: frost action	Severe: seasonal high water table.
Moderate: slope; seasonal high water table.	Moderate: slope	Moderate: slope; frost action.	Severe: seasonal high water table.
Severe: large stones	Severe: large stones	Moderate: large stones; frost action.	Severe: large stones; seasonal high water table.
Severe: slope; large stones	Severe: slope; large stones	Severe: slope	Severe: large stones; seasonal high water table.
Severe: high water table; flooding; organic materials.	Severe: high water table; flooding; surface texture.	Severe: high water table; flooding; frost action; organic material.	Severe: high water table; moderately rapid permeability; organic material; flooding.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: frost action	Severe: depth to bedrock; seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: frost action	Severe: depth to bedrock; seasonal high water table.
Severe: flooding	Moderate: flooding	Moderate: flooding; frost action.	Severe: flooding; permeable substratum.
Moderate: seasonal high water table; shrink-swell potential.	Slight	Moderate: frost action; shrink-swell potential.	Severe: seasonal high water table.
Moderate: seasonal high water table; shrink-swell potential.	Slight	Moderate: frost action; shrink-swell potential.	Severe: seasonal high water table.
Slight	Slight	Slight	Severe: moderately rapid permeability.
Moderate: slope	Moderate: slope	Moderate: slope	Severe: moderately rapid permeability.
Moderate: large stones	Moderate: large stones	Slight	Severe: moderately rapid permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: moderately rapid permeability.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table; frost action.	Severe: flooding; high water table; too clayey.
Moderate: shrink-swell potential; depth to bedrock.	Slight	Moderate: frost action; shrink-swell potential.	Severe: too clayey; depth to bedrock.
Moderate: slope; shrink-swell potential; depth to bedrock.	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.	Severe: too clayey; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: too clayey; depth to bedrock.
Moderate: seasonal high water table; shrink-swell potential.	Slight	Moderate: shrink-swell potential; frost action.	Severe: seasonal high water table.
Moderate: slope; seasonal high water table; shrink-swell potential.	Moderate: slope	Moderate: slope; shrink-swell potential; frost action.	Severe: seasonal high water table.

TABLE 5.—*Soil limitations for*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Ernest: Cont.		
ErD, EvD	Severe: slope; seasonal high water table; moderately slow and slow permeability.	Severe: slope
EvB	Severe: seasonal high water table; moderately slow and slow permeability.	Moderate: slope; large stones
Gilpin:		
GlB	Severe: depth to bedrock	Severe: depth to bedrock
GlC	Severe: depth to bedrock	Severe: slope; depth to bedrock
GlD	Severe: slope; depth to bedrock	Severe: slope; depth to bedrock
Hagerstown:		
HaA	Moderate[2]: depth to bedrock	Moderate[2]: moderate permeability; depth to bedrock.
HaB	Moderate[2]: depth to bedrock	Moderate[2]: slope; moderate permeability; depth to bedrock.
HaC	Moderate[2]: slope; depth to bedrock	Severe[2]: slope
HcB	Moderate[2]: depth to bedrock	Moderate[2]: slope; moderate permeability; depth to bedrock
HcC	Moderate[2]: slope; depth to bedrock	Severe[2]: slope
HcD	Severe[2]: slope	Severe[2]: slope
Hazleton:		
HhB	Moderate: depth to bedrock	Severe: moderately rapid permeability and rapid permeability; small stones.
HhC	Moderate: slope; depth to bedrock	Severe: slope; moderately rapid permeability and rapid permeability; small stones.
HhD	Severe: slope	Severe: slope; moderately rapid and rapid permeability; small stones.
HSB	Severe: large stones	Severe: large and small stones; moderately rapid and rapid permeability.
HSD	Severe: slope; large stones	Severe: slope; large and small stones; moderately rapid and rapid permeability.
HTF:		
Hazleton part	Severe: slope; large stones	Severe: slope; large and small stones; moderately rapid and rapid permeability.
Dekalb part	Severe: slope; depth to bedrock; large stones.	Severe: slope; depth to bedrock; large stones; moderately rapid permeability.
Hublersburg:		
HuA	Slight[2]	Moderate[2]: moderate permeability

town and country planning—Continued

Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.
Moderate: large stones; seasonal high water table; shrink-swell potential.	Moderate: large stones	Moderate: shrink-swell potential; frost action.	Severe: seasonal high water table.
Moderate: depth to bedrock	Moderate: depth to bedrock	Moderate: frost action	Severe: depth to bedrock.
Moderate: slope; depth to bedrock.	Moderate: slope; depth to bedrock.	Moderate: slope; frost action.	Severe: depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: depth to bedrock.
Moderate: depth to bedrock; shrink-swell potential; sinkhole hazard.	Slight	Moderate: shrink-swell potential; frost action.	Severe: too clayey; depth to bedrock.
Moderate: depth to bedrock; shrink-swell potential; sinkhole hazard.	Slight	Moderate: shrink-swell potential; frost action.	Severe: too clayey; depth to bedrock.
Moderate: slope; depth to bedrock; shrink-swell potential; sinkhole hazard.	Moderate: slope	Moderate: slope; shrink-swell potential; frost action.	Severe: too clayey; depth to bedrock.
Moderate: depth to bedrock; shrink-swell potential; sinkhole hazard.	Moderate: surface texture	Moderate: shrink-swell potential; frost action.	Severe: too clayey; depth to bedrock.
Moderate: slope; depth to bedrock; shrink-swell potential; sinkhole hazard.	Moderate: slope; surface texture.	Moderate: slope; shrink-swell potential; frost action.	Severe: too clayey; depth to bedrock.
Severe: slope; sinkhole hazard.	Severe: slope	Severe: slope	Severe: too clayey; depth to bedrock.
Moderate: depth to bedrock	Moderate: surface texture	Slight	Severe: moderately rapid and rapid permeability; depth to bedrock.
Moderate: slope; depth to bedrock.	Moderate: slope; surface texture.	Moderate: slope	Severe: moderately rapid and rapid permeability; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: moderately rapid and rapid permeability; depth to bedrock.
Severe: large stones	Severe: large stones	Moderate: large stones	Severe: large stones; moderately rapid and rapid permeability; depth to bedrock.
Severe: slope; large stones	Severe: slope; large stones	Severe: slope	Severe: large stones; moderately rapid and rapid permeability; depth to bedrock.
Severe: slope; large stones	Severe: slope; large stones	Severe: slope	Severe: slope; depth to bedrock; moderately rapid and rapid permeability; large stones.
Severe: slope; depth to bedrock; large stones.	Severe: slope; large stones	Severe: slope	Severe: slope; depth to bedrock; moderately rapid permeability; large stones.
Moderate: shrink-swell potential; sinkhole hazard.	Slight	Moderate: frost action; shrink-swell potential.	Severe: too clayey.

TABLE 5.—*Soil limitations for*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Hublersburg: Cont.		
HuB	Slight [3]	Moderate [3]: slope; moderate permeability.
HuC	Moderate [3]: slope	Severe [3]: slope
HuD	Severe [3]: slope	Severe [3]: slope
Laidig:		
LaB	Severe: moderately slow permeability	Moderate: slope; small stones
LaC	Severe: moderately slow permeability	Severe: slope
LaD	Severe: slope; moderately slow permeability.	Severe: slope
LcB	Severe: moderately slow permeability; large stones.	Severe: large stones
LcD	Severe: slope; moderately slow permeability; large stones.	Severe: slope; large stones
LDF	Severe: slope; large stones; moderately slow permeability.	Severe: slope; large stones
Leck Kill:		
LkB	Moderate: depth to bedrock	Severe: moderately rapid permeability.
LkC	Moderate: slope; depth to bedrock	Severe: slope; moderately rapid permeability.
LkD, LlD	Severe: slope	Severe: slope; moderately rapid permeability.
LlB	Moderate: large stones; depth to bedrock.	Severe: moderately rapid permeability.
LMF:		
Leck Kill part	Severe: slope	Severe: slope; moderately rapid permeability.
Calvin part	Severe: slope; depth to bedrock	Severe: slope; depth to bedrock; moderately rapid permeability.
Leetonia: LtB	Severe: large stones; depth to bedrock	Severe: large and small stones; moderately rapid permeability.
Leetonia variant:		
LvB	Slight [3]	Severe: rapid permeability
LvC	Moderate [3]: slope	Severe: slope; rapid permeability
Lindside: Lx	Severe: flooding; seasonal high water table.	Severe: flooding; permeable substratum.
Markes: MaB	Severe: high water table; slow permeability; depth to bedrock.	Severe: depth to bedrock; small stones
Meckesville:		
MeB	Severe: moderately slow permeability	Moderate: slope

town and country planning—Continued

Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Moderate: shrink-swell potential; sinkhole hazard.	Slight	Moderate: frost action; shrink-swell potential.	Severe: too clayey.
Moderate: slope; shrink-swell potential; sinkhole hazard.	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.	Severe: too clayey.
Severe: slope; sinkhole hazard.	Severe: slope	Severe: slope	Severe: too clayey.
Slight	Slight	Slight	Slight.
Moderate: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: large stones	Severe: large stones	Moderate: large stones	Severe: large stones.
Severe: slope; large stones	Severe: slope; large stones	Severe: slope	Severe: large stones.
Severe: slope; large stones	Severe: slope; large stones	Severe: slope	Severe: slope; large stones.
Slight	Slight	Slight	Severe: moderately rapid permeability; depth to bedrock.
Moderate: slope	Moderate: slope	Moderate: slope	Severe: moderately rapid permeability; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: moderately rapid permeability; depth to bedrock.
Moderate: large stones	Moderate: large stones	Slight	Severe: moderately rapid permeability; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; moderately rapid permeability; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; moderately rapid permeability; depth to bedrock.
Severe: large stones	Severe: large stones; surface texture.	Moderate: large stones	Severe: large stones; depth to bedrock.
Slight	Severe: surface texture	Slight	Severe: rapid permeability.
Moderate: slope	Severe: surface texture	Moderate: slope	Severe: rapid permeability.
Severe: flooding	Moderate: flooding	Moderate: flooding; frost action.	Severe: flooding; permeable substratum; seasonal high water table.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table; depth to bedrock.
Slight	Slight	Moderate: frost action	Slight.

TABLE 5.—*Soil limitations for*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Meckesville: Cont.		
MeC	Severe: moderately slow permeability	Severe: slope
MkB	Severe: moderately slow permeability	Moderate: slope; large stones
MkD	Severe: slope; moderately slow permeability.	Severe: slope
Melvin: Mm	Severe: flooding; high water table	Severe: flooding
Millheim:		
MnB	Moderate[2]: depth to bedrock	Moderate[2]: slope; moderate permeability; depth to bedrock.
MnC	Moderate[2]: slope; depth to bedrock	Severe[2]: slope
MnD	Severe[2]: slope	Severe[2]: slope
Monongahela: MoB	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope
Morrison:		
MrB	Slight	Severe: moderately rapid permeability
MrC	Moderate: slope	Severe: slope; moderately rapid permeability.
MrD	Severe: slope	Severe: slope; moderately rapid permeability.
MsB	Moderate: large stones	Severe: moderately rapid permeability
MsD	Severe: slope	Severe: slope; moderately rapid permeability.
MTF	Severe: slope	Severe: slope; moderately rapid permeability.
Murrill:		
MuA	Slight[3]	Moderate[2]: moderate permeability; small stones.
MuB	Slight[2]	Moderate[2]: slope; moderate permeability; small stones.
MuC	Moderate[2]: slope	Severe[2]: slope
MuD, MvD	Severe[2]: slope	Severe[2]: slope
MvB	Moderate[2]: large stones	Moderate[2]: slope; large and small stones; moderate permeability.
Nolin: No	Moderate: rare flooding	Severe: rare flooding
*Opequon:		
OhB For Hagerstown part, see Hagerstown series, HcB.	Severe[2]: depth to bedrock	Severe[2]: depth to bedrock
OhC For Hagerstown part, see Hagerstown series, HcC.	Severe[2]: depth to bedrock	Severe[2]: slope; depth to bedrock

town and country planning—Continued

Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Moderate: slope	Moderate: slope	Moderate: slope; frost action.	Slight.
Moderate: large stones	Moderate: large stones	Moderate: frost action	Moderate: large stones.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; large stones.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table; frost action.	Severe: flooding; high water table.
Moderate: shrink-swell potential; depth to bedrock; sinkhole hazard.	Slight	Moderate: frost action; shrink-swell potential.	Severe: too clayey; depth to bedrock.
Moderate: slope; shrink-swell potential; depth to bedrock; sinkhole hazard.	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.	Severe: too clayey; depth to bedrock.
Severe: slope; sinkhole hazard.	Severe: slope	Severe: slope	Severe: too clayey; depth to bedrock.
Moderate: seasonal high water table.	Slight	Moderate: frost action	Severe: seasonal high water table.
Slight	Slight	Moderate: frost action	Severe: moderately rapid permeability.
Moderate: slope	Moderate: slope	Moderate: slope; frost action.	Severe: moderately rapid permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: moderately rapid permeability.
Moderate: large stones	Moderate: large stones	Moderate: frost action	Severe: moderately rapid permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: moderately rapid permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; moderately rapid permeability.
Moderate: shrink-swell potential; sinkhole hazard.	Slight	Moderate: shrink-swell potential; frost action.	Severe: too clayey.
Moderate: shrink-swell potential; sinkhole hazard.	Slight	Moderate: shrink-swell potential; frost action.	Severe: too clayey.
Moderate: slope; shrink-swell potential; sinkhole hazard.	Moderate: slope	Moderate: slope; shrink-swell potential; frost action.	Severe: too clayey.
Severe: slope; sinkhole hazard.	Severe: slope	Severe: slope	Severe: too clayey.
Moderate: large stones; shrink-swell potential; sinkhole hazard.	Moderate: large stones	Moderate: shrink-swell potential; frost action.	Severe: too clayey.
Severe: rare flooding	Slight	Moderate: rare flooding; frost action.	Moderate: rare flooding.
Severe: depth to bedrock; shrink-swell potential; sinkhole hazard.	Severe: depth to bedrock	Severe: depth to bedrock; shrink-swell potential.	Severe: depth to bedrock; too clayey.
Severe: depth to bedrock; shrink-swell potential; sinkhole hazard.	Severe: depth to bedrock	Severe: depth to bedrock; shrink-swell potential.	Severe: depth to bedrock; too clayey.

TABLE 5.—*Soil limitations for*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Opequon: Cont.		
OhD For Hagerstown part, see Hagerstown series, HcD.	Severe [2]: slope; depth to bedrock	Severe [2]: slope; depth to bedrock; hazard of ground water contamination.
ORF:		
Opequon part	Severe [2]: slope; depth to bedrock	Severe [2]: slope; depth to bedrock
Hagerstown part	Severe [2]: slope	Severe [2]: slope
OxB Rock outcrop part is not rated.	Severe [2]: depth to bedrock	Severe [2]: depth to bedrock
OxD Rock outcrop part is not rated.	Severe [2]: slope; depth to bedrock	Severe [2]: slope; depth to bedrock
Philo: Ph	Severe: flooding; seasonal high water table.	Severe: flooding; permeable substratum.
Pk:		
Philo part	Severe: flooding; seasonal high water table.	Severe: flooding; permeable substratum.
Atkins part	Severe: flooding; seasonal high water table; slow permeability.	Severe: flooding
Pope: Po	Severe: flooding	Severe: flooding; moderately rapid permeability.
Purdy: Pu	Severe: high water table; slow permeability.	Slight: inflow hazard; possible pervious substratum.
Rayne: RaB	Moderate: depth to bedrock	Moderate: slope; depth to bedrock; moderate permeability.
Rubble land: Ru	Severe: slope; large stones	Severe: slope; large stones
Strip mines: Sm	Variable	Variable
Tyler: Ty	Severe: seasonal high water table; slow permeability.	Slight: inflow hazard; possible pervious substratum.
Ungers:		
UmB	Moderate: depth to bedrock	Moderate: slope; depth to bedrock; moderate permeability; small stones.
UmC	Moderate: slope; depth to bedrock	Severe: slope
UmD, UnD	Severe: slope	Severe: slope
UnB	Moderate: large stones; depth to bedrock.	Moderate: slope; depth to bedrock; moderate permeability; small and large stones.
*Urban land: URB. Urban land too variable to rate; requires onsite investigation. For Hagerstown part, see Hagerstown series, HaB.		
Vanderlip: VaC	Moderate [2]: slope	Severe [2]: slope; rapid permeability

town and country planning—Continued

Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Severe: slope; depth to bedrock; low strength; shrink-swell potential; sinkhole hazard.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; shrink-swell potential.	Severe: depth to bedrock; too clayey.
Severe: slope; depth to bedrock; shrink-swell potential; sinkhole hazard.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; shrink-swell potential.	Severe: slope; depth to bedrock; too clayey.
Severe: slope; sinkhole hazard.	Severe: slope	Severe: slope	Severe: slope; depth to bedrock; too clayey.
Severe: depth to bedrock; shrink-swell potential; sinkhole hazard.	Severe: depth to bedrock	Severe: depth to bedrock; shrink-swell potential.	Severe: depth to bedrock; too clayey.
Severe: slope; depth to bedrock; shrink-swell potential; sinkhole hazard.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; shrink-swell potential.	Severe: depth to bedrock; too clayey.
Severe: flooding	Moderate: flooding	Moderate: flooding; frost action.	Severe: flooding; permeable substratum; seasonal high water table.
Severe: flooding; seasonal high water table.	Moderate: flooding	Moderate: flooding; frost action.	Severe: flooding; seasonal high water table; permeable substratum.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table; frost action.	Severe: flooding; high water table.
Severe: flooding	Moderate: flooding	Moderate: flooding; frost action.	Severe: flooding; moderately rapid permeability; permeable substratum.
Severe: high water table	Severe: high water table	Severe: high water table; frost action.	Severe: high water table; too clayey; possible pervious substratum.
Slight	Slight	Moderate: frost action	Moderate: depth to bedrock; moderate permeability; too clayey.
Severe: slope; large stones	Severe: slope; large stones	Severe: slope; large stones	Severe: slope; large stones.
Variable	Severe: small stones; extremely acid material.	Variable	Variable.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: frost action	Severe: seasonal high water table; possible pervious substratum.
Moderate: depth to bedrock	Slight	Slight	Severe: depth to bedrock.
Moderate: slope; depth to bedrock.	Moderate: slope	Moderate: slope	Severe: depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: depth to bedrock.
Moderate: large stones; depth to bedrock.	Moderate: large stones	Slight	Severe: depth to bedrock.
Moderate: slope	Severe: surface texture	Moderate: slope	Severe: rapid permeability.

TABLE 5.—*Soil limitations for*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons
Weikert:		
WeC	Severe: depth to bedrock	Severe: slope; depth to bedrock; moderately rapid permeability; small stones.
WeD	Severe: slope; depth to bedrock	Severe: slope; depth to bedrock; moderately rapid permeability; small stones.
Wharton:		
WhA	Severe: seasonal high water table; moderately slow permeability.	Moderate: depth to bedrock
WhB	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope; depth to bedrock
WhC	Severe: seasonal high water table; moderately slow permeability.	Severe: slope
Wyoming: WyA	Moderate[2]: rare flooding	Severe[2]: rapid permeability; small stones; rare flooding.

[1] Onsite studies of the underlying strata, water table, and hazards of aquifer pollution into ground water need to be made for landfill deeper than 5 or 6 feet.

ball, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrop, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Golf fairways are used intensively and are subject to heavy foot traffic. Most of the vehicular traffic is confined to hard surface trails and roads. The best soils have good drainage, gentle slopes, a surface free of rock fragments and stones, and a surface that is firm after rain but not dusty when dry.

Engineering Uses of the Soils [4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

[4] JOHN JAQUISH, civil engineer, Soil Conservation Service, helped to prepare this section.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 7, 8, and 9, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 7 and 8, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally a depth of more than 6 feet. Also, inspection of sites, especially

town and country planning—Continued

Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill [1] (trench)
Moderate: slope; depth to bedrock.	Severe: depth to bedrock; small stones.	Moderate: slope; depth to bedrock.	Severe: depth to bedrock; moderately rapid permeability.
Severe: slope	Severe: slope; depth to bedrock; small stones.	Severe: slope	Severe: depth to bedrock; moderately rapid permeability.
Moderate: seasonal high water table; shrink-swell potential.	Slight	Severe: frost action	Severe: seasonal high water table; depth to bedrock.
Moderate: seasonal high water table; shrink-swell potential.	Slight	Severe: frost action	Severe: seasonal high water table; depth to bedrock.
Moderate: slope; seasonal high water table; shrink-swell potential.	Moderate: slope	Severe: frost action	Severe: seasonal high water table; depth to bedrock.
Severe: rare flooding	Severe: small stones	Moderate: rare flooding	Severe: rapid permeability.

[1] Possible ground water pollution because of rapid permeability, coarse texture, creviced bedrock, or sinkholes.

small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering soil classfication systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*3*) used by the SCS engineers, Department of Defense, and others, and the AASHTO (*2*) system adopted by the American Association of State Highway and Transportation Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and content of organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 9; the estimated classification, without group index numbers, is given in table 7 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 7. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 7.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Soil texture is described in table 7 in the standard terms used by the United States Department of Agriculture (USDA). These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent

TABLE 6.—*Soil limitations for*

[An asterisk in the first column indicates that at least one mapping unit is made of two or more kinds of soil. The soils in such for referring to other

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements
Albrights: AbB	Moderate: moderately slow permeability.	Moderate: frost action
AbC	Moderate: slope; moderately slow permeability.	Moderate: slope; frost action
AcB	Moderate: large stones; moderately slow permeability.	Moderate: large stones; frost action
AcC	Moderate: slope; large stones; moderately slow permeability.	Moderate: slope; large stones; frost action.
Allegheny: AlB	Slight	Severe: frost action
Andover: AnB, AoB	Severe: high water table	Severe: high water table; frost action
AnC, AoC	Severe: high water table	Severe: high water table; frost action
Armagh: ArA, ArB	Severe: high water table	Severe: high water table; frost action
Atkins: At	Severe: flooding; high water table	Severe: flooding; high water table; frost action.
Basher: Ba	Moderate: flooding	Severe: flooding
Berks: BkB	Moderate: small stones	Slight
BkC	Moderate: slope; small stones	Moderate: slope
BkD, BlD	Severe: slope	Severe: slope
BMF Interpretations for BMF apply to Weikert part of unit as well as to Berks part.	Severe: slope	Severe: slope
Brinkerton: BrA, BrB, BsB	Severe: high water table	Severe: high water table; frost action
BrC	Severe: high water table	Severe: high water table; frost action
Buchanan: BtB	Moderate: slow permeability	Moderate: frost action
BuB	Moderate: slow permeability; small stones.	Moderate: frost action
BuC	Moderate: slope; slow permeability; small stones.	Moderate: slope; frost action
BxB	Severe: large stones	Severe: large stones
BxD	Severe: slope; large stones	Severe: slope; large stones

recreational development

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions series as indicated]

Paths and trails	Picnic areas	Playgrounds	Golf fairways
Slight	Slight	Moderate: slope; seasonal high water table; moderately slow permeability.	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.
Moderate: large stones	Slight	Moderate: slope; large stones; seasonal high water table; moderately slow permeability.	Moderate: large stones.
Moderate: large stones	Moderate: slope	Severe: slope	Moderate: large stones.
Slight	Slight	Moderate: slope	Slight.
Severe: high water table	Severe: high water table	Severe: high water table; small stones.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: slope; high water table; small stones.	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.
Slight	Moderate: flooding	Moderate: flooding; seasonal high water table.	Moderate: flooding.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: depth to bedrock; small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; depth to bedrock; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Severe: slope	Severe: slope	Severe: slope; small stones	Severe: slope.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: slope; high water table.	Severe: high water table.
Slight	Slight	Moderate: slope; seasonal high water table; slow permeability.	Slight.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones.
Severe: large stones	Moderate: small and large stones.	Severe: small and large stones.	Severe: large stones.
Severe: large stones	Severe: slope	Severe: slope; small and large stones.	Severe: slope; large stones.

TABLE 6.—*Soil limitations for*

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements
Carlisle: CA	Severe: organic material; high water table; flooding.	Severe: organic material; high water table; flooding; frost action; shrink-swell potential.
Cavode: CdA, CdB	Moderate: seasonal high water table	Severe: frost action
Chagrin: Ch	Moderate: flooding	Severe: flooding
Clarksburg:		
CkA	Moderate: slow permeability	Moderate: frost action; shrink-swell potential.
CkB	Moderate: slow permeability	Moderate: frost action; shrink-swell potential.
Clymer:		
ClB	Slight	Slight
ClC	Moderate: slope	Moderate: slope
CvB	Moderate: large stones	Moderate: large stones
CvD	Severe: slope	Severe: slope
Dunning: Du	Severe: flooding; high water table	Severe: flooding; high water table; frost action.
Edom:		
EdB	Slight	Moderate: frost action; shrink-swell potential.
EdC	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.
EdD	Severe: slope	Severe: slope
Ernest:		
ErB	Moderate: small stones; moderately slow and slow permeability.	Moderate: frost action; shrink-swell potential.
ErC	Moderate: slope; small stones; moderately slow and slow permeability.	Moderate: slope; frost action; shrink-swell potential.
ErD, EvD	Severe: slope	Severe: slope
EvB	Moderate: small and large stones; moderately slow and slow permeability.	Moderate: large stones; frost action; shrink-swell potential.
Gilpin:		
GlB	Moderate: small stones	Moderate: frost action
GlC	Moderate: slope; small stones	Moderate: slope; frost action
GlD	Severe: slope	Severe: slope
Hagerstown:		
HaA	Slight	Moderate: frost action; shrink-swell potential.
HaB	Slight	Moderate: frost action; shrink-swell potential.
HaC	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.

recreational development—Continued

Paths and trails	Picnic areas	Playgrounds	Golf fairways
Severe: organic material; high water table; flooding.	Severe: organic material; high water table; flooding.	Severe: organic material; high water table; flooding.	Severe: organic material; high water table; flooding.
Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Slight	Moderate: flooding	Moderate: flooding	Moderate: flooding.
Slight	Slight	Moderate: seasonal high water table; slow permeability.	Slight.
Slight	Slight	Moderate: slope; seasonal high water table; slow permeability.	Slight.
Slight	Slight	Moderate: slope	Moderate: surface texture.
Slight	Moderate: slope	Severe: slope	Moderate: slope; surface texture.
Moderate: large stones	Slight	Moderate: slope; large stones.	Moderate: large stones; surface texture.
Moderate: slope; large stones.	Severe: slope	Severe: slope	Severe: slope.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.
Slight	Slight	Moderate: slope	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.
Moderate: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Moderate: small and large stones.	Moderate: small stones	Severe: small stones	Moderate: small and large stones.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: depth to bedrock; small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; depth to bedrock; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Slight	Slight	Slight	Slight.
Slight	Slight	Moderate: slope	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.

TABLE 6.—*Soil limitations for*

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements
Hagerstown: Cont.		
HcB	Moderate: surface texture	Moderate: frost action; shrink-swell potential.
HcC	Moderate: slope; surface texture	Moderate: slope; frost action; shrink-swell potential.
HcD	Severe: slope	Severe: slope
Hazleton:		
HhB	Moderate: small stones	Slight
HhC	Moderate: slope; small stones	Moderate: slope
HhD	Severe: slope	Severe: slope
HSB	Severe: large stones	Severe: large stones
HSD	Severe: slope; large stones	Severe: slope; large stones
HTF	Severe: slope; large stones	Severe: slope; large stones
Interpretations for HTF apply to Dekalb part as well as to Hazleton part of unit.		
Hublersburg:		
HuA	Slight	Moderate: frost action; shrink-swell potential.
HuB	Slight	Moderate: frost action; shrink-swell potential.
HuC	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.
HuD	Severe: slope	Severe: slope
Laidig:		
LaB	Moderate: small stones; moderately slow permeability.	Slight
LaC	Moderate: slope; small stones; moderately slow permeability.	Moderate: slope
LaD	Severe: slope	Severe: slope
LcB	Severe: large stones	Severe: large stones
LcD	Severe: slope; large stones	Severe: slope; large stones
LDF	Severe: slope; large stones	Severe: slope; large stones
Leck Kill:		
LkB	Moderate: small stones	Moderate: frost action
LkC	Moderate: slope; small stones	Moderate: slope; frost action
LkD	Severe: slope	Severe: slope

recreational development—Continued

Paths and trails	Picnic areas	Playgrounds	Golf fairways
Moderate: surface texture	Moderate: surface texture	Moderate: slope; surface texture.	Moderate: surface texture.
Moderate: surface texture	Moderate: slope; surface texture.	Severe: slope	Moderate: slope; surface texture.
Moderate: slope; surface texture.	Severe: slope	Severe: slope	Severe: slope.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones; surface texture.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones; surface texture.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Severe: large stones	Moderate: small and large stones.	Severe: small and large stones.	Severe: large stones.
Severe: large stones	Severe: slope	Severe: slope; small and large stones.	Severe: slope; large stones.
Severe: slope; large stones	Severe: slope	Severe: slope; small and large stones.	Severe: slope; large stones.
Slight	Slight	Slight	Slight.
Slight	Slight	Moderate: slope	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.
Moderate: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Severe: large stones	Moderate: small and large stones.	Severe: small and large stones.	Severe: large stones.
Severe: large stones	Severe: slope	Severe: slope; small and large stones.	Severe: slope, large stones.
Severe: slope; large stones	Severe: slope	Severe: slope; small and large stones.	Severe: slope; large stones.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.

TABLE 6.—*Soil limitations for*

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements
Leck Kill: Cont.		
LlB	Moderate: small and large stones	Moderate: large stones; frost action
LlD	Severe: slope	Severe: slope
LMF Interpretations for LMF apply to Calvin part of unit as well as to Leck Kill part.	Severe: slope	Severe: slope
Leetonia: LtB	Severe: large stones	Severe: large stones
Leetonia variant:		
LvB	Severe: surface texture	Slight
LvC	Severe: surface texture	Moderate: slope
Lindside: Lx	Moderate: flooding	Severe: flooding
Markes: MaB	Severe: high water table	Severe: high water table; frost action
Meckesville:		
MeB	Moderate: moderately slow permeability.	Moderate: frost action
MeC	Moderate: slope; moderately slow permeability.	Moderate: slope; frost action
MkB	Moderate: large stones; moderately slow permeability.	Moderate: large stones; frost action
MkD	Severe: slope	Severe: slope
Melvin: Mm	Severe: flooding; high water table	Severe: flooding; high water table; frost action.
Millheim:		
MnB	Slight	Moderate: frost action; shrink-swell potential.
MnC	Moderate: slope	Moderate: slope; frost action; shrink-swell potential.
MnD	Severe: slope	Severe: slope
Monongahela: MoB	Moderate: moderately slow permeability.	Moderate: frost action
Morrison:		
MrB	Slight	Moderate: frost action
MrC	Moderate: slope	Moderate: slope; frost action
MrD	Severe: slope	Severe: slope
MsB	Moderate: large stones	Moderate: large stones; frost action
MsD	Severe: slope	Severe: slope
MTF	Severe: slope	Severe: slope

recreational development—Continued

Paths and trails	Picnic areas	Playgrounds	Golf fairways
Moderate: small and large stones.	Moderate: small stones	Severe: small stones	Moderate: small and large stones.
Moderate: slope; small and large stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Severe: slope	Severe: slope	Severe: slope; small stones	Severe: slope.
Severe: large stones	Moderate: small and large stones; surface texture.	Severe: small and large stones.	Severe: large stones; surface texture.
Severe: surface texture	Severe: surface texture	Severe: surface texture	Severe: surface texture.
Severe: surface texture	Severe: surface texture	Severe: slope; surface texture.	Severe: surface texture.
Slight	Moderate: flooding	Moderate: flooding; seasonal high water table.	Moderate: flooding.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Slight	Slight	Moderate: slope; moderately slow permeability.	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.
Moderate: large stones	Slight	Moderate: slope; large stones; moderately slow permeability.	Moderate: large stones.
Moderate: slope; large stones.	Severe: slope	Severe: slope	Severe: slope.
Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.
Slight	Slight	Moderate: slope	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.
Moderate: slope	Severe: slope	Severe: slope	Severe: slope.
Slight	Slight	Moderate: slope; seasonal high water table; moderately slow permeability.	Slight.
Slight	Slight	Moderate: slope	Moderate: surface texture.
Slight	Moderate: slope	Severe: slope	Moderate: slope; surface texture.
Moderate: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: large stones	Slight	Moderate: slope; large stones.	Moderate: large stones; surface texture.
Moderate: slope; large stones.	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 6.—*Soil limitations for*

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements
Murrill:		
MuA, MuB	Moderate: small stones	Moderate: frost action; shrink-swell potential.
MuC	Moderate: slope; small stones	Moderate: slope; frost action; shrink-swell potential.
MuD	Severe: slope	Severe: slope
MvB	Moderate: small and large stones	Moderate: large stones; frost action; shrink-swell potential.
MvD	Severe: slope	Severe: slope
Nolin: No	Slight	Moderate: rare flooding
*Opequon:		
OhB	Moderate: surface texture	Severe: depth to bedrock; shrink-swell potential.
For Hagerstown part, see Hagerstown series, HcB.		
OhC	Moderate: slope; surface texture	Severe: depth to bedrock; shrink-swell potential.
For Hagerstown part, see Hagerstown series, HcC.		
OhD	Severe: slope	Severe: slope; depth to bedrock; shrink-swell potential.
For Hagerstown part, see Hagerstown series, HcD.		
ORF:		
Opequon part	Severe: slope	Severe: slope; depth to bedrock; shrink-swell potential.
Hagerstown part	Severe: slope	Severe: slope
OxB	Moderate: surface texture	Severe: depth to bedrock; shrink-swell potential.
Rock outcrop part is not rated.		
OxD	Severe: slope	Severe: slope; depth to bedrock; shrink-swell potential.
Rock outcrop part is not rated.		
Philo: Ph	Moderate: flooding	Severe: flooding
Pk:		
Philo part	Moderate: flooding; moderately slow permeability; large stones.	Severe: flooding
Atkins part	Severe: flooding; high water table	Severe: flooding; high water table; frost action.
Pope: Po	Moderate: flooding	Severe: flooding
Purdy: Pu	Severe: high water table	Severe: high water table; frost action
Rayne: RaB	Slight	Moderate: frost action
Rubble land: Ru	Severe: large stones; slope	Severe: large stones; slope
Strip mines: Sm	Severe: small stones	Variable

recreational development—Continued

Paths and trails	Picnic areas	Playgrounds	Golf fairways
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Moderate: small and large stones.	Moderate: small stones	Severe: small stones	Moderate: small and large stones.
Moderate: slope; small and large stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Slight	Slight	Slight	Slight.
Moderate: surface texture	Moderate: surface texture	Severe: depth to bedrock	Severe: depth to bedrock.
Moderate: surface texture	Moderate: slope; surface texture.	Severe: slope; depth to bedrock.	Severe: depth to bedrock.
Moderate: slope; surface texture.	Severe: slope	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: surface texture	Moderate: surface texture	Severe: depth to bedrock	Severe: depth to bedrock.
Moderate: slope; surface texture.	Severe: slope	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.
Slight	Moderate: flooding	Moderate: flooding; seasonal high water table.	Moderate: flooding.
Moderate: large stones	Moderate: flooding	Severe: flooding; seasonal high water table.	Moderate: flooding.
Severe: high water table	Severe: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.
Slight	Moderate: flooding	Moderate: flooding	Moderate: flooding.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Slight	Slight	Moderate: slope	Slight.
Severe: large stones; slope	Severe: large stones; slope.	Severe: large stones; slope	Severe: large stones.
Severe: small stones	Severe: small stones	Severe: slope; small stones	Severe: small stones.

TABLE 6.—*Soil limitations for*

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements
Tyler: Ty	Moderate: seasonal high water table; slow permeability.	Severe: frost action
Ungers:		
UmB	Moderate: small stones	Slight
UmC	Moderate: slope; small stones	Moderate: slope
UmD	Severe: slope	Severe: slope
UnB	Moderate: small and large stones	Moderate: large stones
UnD	Severe: slope	Severe: slope
*Urban land: URB. Too variable to rate; requires onsite investigation. For Hagerstown part, see Hagerstown series, HaB.		
Vanderlip: VaC	Moderate: slope; surface texture	Moderate: slope
Weikert:		
WeC	Moderate: slope; small stones	Moderate: depth to bedrock; slope
WeD	Severe: slope	Severe: slope
Wharton:		
WhA	Moderate: moderately slow permeability.	Severe: frost action
WhB	Moderate: moderately slow permeability.	Severe: frost action
WhC	Moderate: slope; moderately slow permeability.	Severe: frost action
Wyoming: WyA	Moderate: small stones	Moderate: rare flooding

sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 7 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH. The pH value and terms used to describe reaction are explained in the Glossary.

Optimum moisture for compaction and maximum dry density are discussed in the section "Soil test data."

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosion potential or corrosivity, as used in table 7, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to such soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Ratings of soils for corrosivity for concrete are based mainly on

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Paths and trails	Picnic areas	Playgrounds	Golf fairways
Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; small stones	Moderate: slope; small stones.
Moderate: slope; small stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Moderate: small and large stones.	Moderate: small stones	Severe: small stones	Moderate: small and large stones.
Moderate: slope; small and large stones.	Severe: slope	Severe: slope; small stones	Severe: slope.
Moderate: surface texture	Moderate: slope; surface texture.	Severe: slope	Severe: surface texture.
Moderate: small stones	Moderate: slope; small stones.	Severe: slope; depth to bedrock; small stones.	Moderate: slope; depth to bedrock.
Moderate: slope; small stones.	Severe: slope	Severe: slope; depth to bedrock; small stones.	Severe: slope.
Slight	Slight	Moderate: seasonal high water table; moderately slow permeability.	Slight.
Slight	Slight	Moderate: slope; seasonal high water table; moderately slow permeability.	Slight.
Slight	Moderate: slope	Severe: slope	Moderate: slope.
Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.

soil texture and acidity. Installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of soils

The interpretations in table 8 are based on the estimated engineering properties of soils shown in table 7, on test data for soils in this county and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Centre County. In table 8, the ratings good, fair, poor, and unsuited are used to summarize suitability of the soils as source material for topsoil, sand and gravel, and roadfill. For highway and road location, pond reservoirs and embankments, drainage, sprinkler irrigation, terraces and diversions, grassed waterways, winter grading, and pipeline construction and maintenance, table 8 lists those soil features not to be overlooked in planning, installation, and maintenance.

Following are explanations of some of the columns in table 8.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material when preparing a seedbed, natural fertility of the material or the response of plants when fertilizer is applied, and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance about where to look for probable sources.

TABLE 7.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit of that series is made up of two or more kinds of soil. The referring to other series that appear in the first

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Ft	*Ft*	*In*				*Pct*
Albrights: AbB, AbC, AcB, AcC.	1½–3	>5	0–6	Silt loam	ML, CL, or CL–ML	A–4 or A–6	0–10
			6–27	Loam, clay loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4 or A–6	5–20
			27–60	Channery loam	ML, CL, SM, SC GM, or GC	A–4, A–2, or A–6	5–20
Allegheny: AlB.	>6	>6	0–11	Silt loam	ML, CL, or CL–ML	A–4	
			11–33	Silt loam, clay loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4 or A–6	0–5
			33–60	Gravelly loam	SM, SC, GM, GC, ML, or CL	A–2, A–4, A–1, or A–6	0–5
Andover: AnB, AnC, AoB, AoC.	0–½	4–>20	0–10	Channery loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4	0–10
			10–23	Channery loam, channery clay loam.	SM, SC, SM–SC, ML, CL, or CL–ML	A–4, A–2 or A–6	0–15
			23–60	Gravelly clay loam, gravelly sandy clay loam.	SM, SC, or SM–SC	A–2, A–4, or A–6	0–25
Armagh: ArA, ArB.	0–½	3½–6	0–8	Silt loam	ML or CL	A–4 or A–6	0–5
			8–38	Silty clay loam, shaly silty clay loam.	ML, CL, MH, or CH	A–7, A–6, A–4, or A–5	0–10
			38–44	Shaly loam	GM, GC, SM, or SC	A–2, A–4, A–6, or A–7	0–20
			44	Shale bedrock (weathered).			
Atkins: At	0–½	>6	0–7	Silt loam	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	
			7–44	Silty clay loam, loam, clay loam, gravelly loam.	ML, CL, or CL–ML	A–6, A–4, A–7, or A–5	0–5
			44–61	Gravelly loam, gravelly sandy loam.	ML, CL, SM, SC, GM, or GC	A–2, A–4, A–5, or A–6	0–10
Basher: Ba	1½–3	>6	0–33	Loam	ML, CL, or CL–ML	A–4	0–5
			33–60	Very gravelly loam	SM, SC, GM, GC, ML, or CL	A–4 or A–2	0–25
*Berks: BkB, BkC, BkD, BlD, BMF. For Weikert part of BMF, see Weikert series.	>6	1½–3½	0–10	Shaly silt loam	SM, SC, GM, GC, ML, or CL	A–4 or A–2	0–20
			10–24	Very shaly silt loam	GM, GC, GM–GC, SM, SC, or SM–SC	A–2 or A–1	0–40
			24	Shale bedrock (weathered).			
Brinkerton: BrA, BrB, BrC, BsB.	0–½	>5	0–9	Silt loam	ML or CL	A–4, A–6, A–5, or A–7	0–10
			9–21	Silt loam; silty clay loam.	ML or CL	A–4, A–6, A–5, or A–7	0–10
			21–62	Shaly silt loam	ML, CL, GM, GC, SM, or SC	A–4, A–6, A–5, or A–7	0–15
Buchanan: BtB, BuB, BuC, BxB, BxD.	1½–3	>5	0–15	Channery loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4 or A–6	0–10
			15–27	Channery loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4 or A–6	5–15
			27–60	Channery loam	SM, SC, GM, GC, ML, or CL	A–4, A–6, or A–2	5–15

significant to engineering

soils in such mapping units may have different properties, and for this reason it is necessary to follow carefully the instructions for column of this table. The symbol > means more than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.073 mm)							Uncoated steel	Concrete
				In/hr	*In/in of depth*	*pH*	*Pct*	*Lb/cu ft*			
80–100	80–95	70–90	55–80	0.6–2.0	0.16–0.20	4.0–5.5			Low	High	High.
80–100	70–100	65–90	40–80	0.6–2.0	0.09–0.14	4.0–5.5	12–19	105–118	Low	High	High.
70–100	60–90	50–80	30–75	0.2–0.6	0.06–0.10	4.5–6.5	10–16	110–124	Low	High	High.
90–100	90–100	70–100	55–90	2.0–6.0	0.15–0.22	4.0–5.5			Low	Low	High.
90–100	80–100	65–95	40–75	0.6–2.0	0.13–0.18	4.0–5.5	10–16	110–124	Low	Moderate	High.
70–90	55–90	45–65	20–55	0.6–2.0	0.10–0.17	4.0–5.5	8–14	114–128	Low	Low	High.
80–95	70–90	65–85	45–65	0.6–2.0	0.12–0.20	4.5–5.5			Low	High	High.
80–95	65–90	65–85	30–60	0.2–2.0	0.08–0.12	4.5–5.5	12–18	106–120	Low	High	High.
80–95	65–90	60–85	30–50	0.06–0.2	0.06–0.10	4.5–5.5	10–15	112–124	Low	High	High.
95–100	90–100	80–95	75–85	0.6–2.0	0.18–0.22	4.5–5.5			Low	High	High.
85–95	75–90	70–85	65–85	0.06–0.2	0.10–0.14	4.5–5.5	14–20	102–115	Moderate	High	High.
65–85	20–75	20–60	20–45	0.06–0.6	0.08–0.12	4.5–5.5	14–20	102–115	Moderate	High	High.
90–100	90–100	80–100	60–95	0.6–2.0	0.14–0.22	4.5–5.5			Low	High	High.
85–100	80–100	70–90	50–85	0.06–0.6	0.14–0.18	4.5–5.5	12–18	106–118	Low	High	High.
60–95	55–95	50–80	30–80	0.6–2.0	0.08–0.18	4.5–5.5	10–15	112–124	Low	High	High.
80–100	70–100	60–100	55–95	0.6–2.0	0.14–0.18	4.5–6.0	12–17	106–118	Low	Moderate	Moderate.
45–95	40–90	40–80	35–75	0.6–2.0	0.10–0.12	5.1–6.0	10–16	110–124	Low	Moderate	Moderate.
50–80	45–70	40–60	30–55	2.0–6.0	0.08–0.12	4.5–5.5			Low	Low	High.
40–65	30–55	25–45	20–35	2.0–6.0	0.04–0.08	4.5–5.5	9–15	112–125	Low	Low	High.
90–100	90–100	85–100	80–100	0.6–6.0	0.18–0.24	4.5–6.0			Moderate	High	Moderate.
90–100	90–100	85–100	70–100	0.6–2.0	0.14–0.18	4.5–6.0	14–20	102–115	Moderate	High	Moderate.
70–95	45–95	40–90	35–85	0.06–0.2	0.08–0.12	4.5–6.0	12–17	106–118	Moderate	High	Moderate.
85–100	75–100	60–80	45–75	0.6–2.0	0.18–0.24	4.0–55			Low	Moderate	High.
85–100	60–100	55–80	45–75	0.6–2.0	0.12–0.18	4.0–5.5	12–16	110–120	Low	Moderate	High.
65–85	30–80	30–80	25–60	0.06–0.2	0.08–0.12	4.5–5.5	10–14	114–124	Low	Moderate	High.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Ft	*Ft*	*In*				*Pct*
Calvin ---------- Mapped only with Leck Kill soils.	>6	1½–3½	0–7	Channery loam -------	ML, CL, GM, GC, SM, or SC	A–4 or A–6	5–10
			7–35	Channery loam -------	GM, GC, SM, SC, ML, or CL	A–2, A–1, A–4, or A–6	5–10
			35–39	Very channery loam --	GM, GC, SM, SC, GW–GM, or SW–SM	A–2, A–1, A–4, or A–6	10–20
			39	Siltstone bedrock (weathered).			
Carlisle: CA.	0	>6	0–111	Muck ----------	Pt	----------	----------
			111–118	Silt loam ----------	ML, CL, or CL–ML	A–4 or A–6	----------
Cavode: CdA, CdB.	½–1½	3½–6	0–7	Silt loam ----------	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	----------
			7–36	Silty clay loam -------	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	----------
			36–52	Shaly silty clay loam --	ML, CL, SM, SC, GM, or GC	A–4, A–6, A–7, or A5	0–15
			52	Shale bedrock (weathered).			
Chagrin: Ch ----	>3	>6	0–14	Silt loam ----------	ML, CL, or CL–ML	A–4	----------
			14–41	Silt loam, loam -------	ML, CL, CL–ML, SM, SC, or SM–SC	A–4	----------
			41–60	Silt loam ----------	ML, CL, CL–ML, SM, SC, or SM–SC	A–4	----------
Clarksburg: CkA, CkB.	1½–3	>5	0–14	Silt loam ----------	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	0–5
			14–35	Silt loam, silty clay loam.	CL, ML, or CL–ML	A–4, A–6, A–7, or A–5	0–10
			35–48	Silty clay loam -------	ML, CL, CL–ML, SM, SC, or SM–SC	A–4, A–6, A–7, or A–5	0–15
			48–63	Channery silty clay loam.	ML, CL, GM, GC, SM, or SC	A–4, A–6, A–7, or A–2	5–20
Clymer: ClB, ClC, CvB, CvD.	>6	>5	0–10	Sandy loam ----------	GM, GC, SM, SC, ML, or CL	A–4 or A–2	0–15
			10–28	Channery sandy loam--	GM, GC, SM, SC, ML, or CL	A–4 or A–2	5–20
			28–81	Channery sandy loam, very channery sandy loam.	GM, GC, GM–GC, SM, SC, or SM–SC	A–2, A–1, or A–4	10–30
Dekalb ---------- Mapped only with Hazleton soils.	>6	1½–3½	0–9	Channery sandy loam--	GM or SM	A–2, A–4, or A–1	10–50
			9–36	Very channery sandy loam, very channery loamy sand.	GM, SM, GW–GM, or SW–SM	A–1 or A–2	10–50
			36	Sandstone bedrock.			
Dunning: Du ----	0	>6	0–15	Silty clay loam -------	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	----------
			15–66	Silty clay, silty clay loam.	CL, MH, CH, or MH–CH	A–7	----------
Edom: EdB, EdC, EdD.	>6	3½–6	0–7	Silt loam ----------	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	----------
			7–29	Silty clay loam, clay,	ML, CL, CL–ML, MH, CH, or MH–CH	A–7 or A–6	0–10
			29–47	Very shaly silty clay --	GM, GC, SM, SC, ML, or CL	A–4, A–6, A–2, or A–7	5–20
			47	Interbedded shale and limestone bedrock.			

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.073 mm)							Uncoated steel	Concrete
				In/hr	*In/in of depth*	*pH*	*Pct*	*Lb/cu ft*			
70–85	65–80	40–75	35–65	2.0–6.0	0.10–0.14	4.5–5.5			Low	Low	High.
45–80	40–75	35–70	25–55	2.0–6.0	0.08–0.12	4.5–5.5	10–16	110–124	Low	Low	High.
30–70	25–65	20–50	10–40	2.0–6.0	0.06–0.10	4.5–5.5	10–15	110–125	Low	Low	High.
				2.0–6.0	0.20–0.30	4.5–5.5			High	High	High.
100	90–100	80–100	75–95	0.06–0.2	0.10–0.14	4.5–6.5	12–18	106–118	Low	High	Moderate.
90–100	85–100	80–95	75–95	0.6–2.0	0.18–0.22	4.5–5.5			Low	High	High.
85–100	80–100	80–95	70–95	0.06–0.2	0.10–0.14	4.5–5.5	15–20	100–112	Moderate	High	High.
65–90	55–85	50–80	40–75	0.06–0.2	0.08–0.12	4.5–5.5	12–18	106–118	Moderate	High	High.
95–100	80–100	75–100	70–90	0.6–2.0	0.15–0.19	5.6–7.3			Low	Low	Low.
90–100	80–100	75–90	45–80	0.6–2.0	0.13–0.17	5.6–7.3	10–16	110–120	Low	Low	Low.
85–100	80–100	70–85	40–75	0.6–6.0	0.10–0.16	5.6–7.3	9–14	114–125	Low	Low	Low.
95–100	90–100	80–95	75–90	0.6–2.0	0.14–0.20	5.1–6.5			Low	Moderate	Moderate.
80–100	75–100	70–95	55–85	0.6–2.0	0.12–0.18	5.1–6.5	18–24	95–107	Moderate	High	Moderate.
75–100	65–100	60–95	45–85	0.06–0.2	0.06–0.12	5.1–6.5	14–19	105–115	Moderate	High	Moderate.
50–100	25–100	20–95	15–90	0.06–0.6	0.08–0.12	4.5–5.5	12–17	106–120	Moderate	High	High.
60–85	60–80	45–75	30–65	2.0–6.0	0.10–0.16	4.0–5.5			Low	Low	High.
60–85	55–75	40–65	30–55	2.0–6.0	0.10–0.12	4.0–5.5	9–14	114–125	Low	Low	High.
40–75	25–70	20–60	10–45	2.0–6.0	0.04–0.08	4.0–5.5	8–12	118–128	Low	Low	High.
45–80	40–75	30–60	15–50	2.0–6.0	0.10–0.12	4.0–5.5			Low	Low	High.
30–65	25–600	15–45	5–35	2.0–6.0	0.04–0.08	4.0–5.5	8–12	118–128	Low	Low	High.
100	95–100	90–100	85–100	0.2–2.0	0.19–0.23	5.6–7.8			Moderate	High	Moderate.
95–100	95–100	90–100	85–100	0.06–0.2	0.14–0.18	5.6–7.8	15–23	97–112	Moderate	High	Moderate.
85–100	80–100	75–95	70–90	0.6–2.0	0.14–0.20	5.1–7.8			Low	Moderate	Low.
75–95	65–90	65–85	55–85	0.6–2.0	0.10–0.14	5.1–7.8	22–28	90–104	Moderate	High	Low.
30–80	20–70	15–60	15–55	0.6–2.0	0.04–0.08	5.6–7.8	15–22	98–112	Moderate	High	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Ft	*Ft*	*In*				*Pct*
Ernest: ErB, ErC, ErD, EvB, EvD.	1½–3	>5	0–8	Channery silt loam	ML, CL, or CL–ML	A–4 or A–6	0–15
			8–26	Channery silt loam, silty clay loam.	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	0–15
			26–80	Channery silty clay loam.	ML, CL, SM, SC, GM, or GC	A–4, A–6, A–7, or A–5	5–20
Gilpin: GlB, GlC, GlD.	>6	1½–3½	0–9	Channery silt loam	ML, CL, or CL–ML	A–4 or A–6	0–10
			9–22	Channery loam	ML, CL, GM, GC, SM, or SC	A–4 or A–6	0–20
			22–32	Very channery loam	GM, GC, or GM–GC	A–1, A–2, or A–4	5–30
			32	Shale bedrock (weathered).			
Hagerstown: HaA, HaB, HaC, HcB, HcC, HcD.	>6	3½–7	0–8	Silt loam	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	0–5
			8–45	Silty clay, clay, silty clay loam.	ML, CL, CL–ML, MH, CH, or MH–CH	A–6 or A–7	0–5
			45–75	Clay loam	ML, CL, CL–ML, MH, CH, or MH–CH	A–6 or A–7	0–5
			75	Limestone bedrock.			
*Hazleton: HhB, HhC, HhD, HSB, HSD, HTF. For Dakalb part of HTF, see Dekalb series.	>6	3½–7	0–8	Channery sandy loam	SM, SM–SC, GM, GM–GC, ML, or CL–ML	A–4	10–15
			8–35	Channery sandy loam, very channery sandy loam.	SM, SM–SC, GM, GM–GC, ML, or CL	A–2, A–1, or A–4	0–50
			35–60	Very channery sandy loam.	SM, GM, GW–GM, or SW–SM	A–2 or A–1	10–40
Hublersburg: HuA, HuB, HuC, HuD.	>6	>5	0–9	Silt loam	ML, CL, or CL–ML	A–4 or A–6	
			9–54	Silty clay loam, silty clay.	ML, CL, CL–ML, MH, CH, or MH–CH	A–6 or A–7	0–5
			54–70	Cherty silty clay, cherty silty clay loam.	ML, CL, CL–ML, MH, CH, or MH–CH	A–6 or A–7	0–5
Laidig: LaB, LaC, LaD, LcB, LcD, LDF.	>6	>6	0–12	Channery loam	GM, GC, SM, SC, ML, or CL	A–4 or A–6	5–25
			12–40	Channery loam	GM, GC, GM–GC, SM, SC, or SM–SC	A–2, A–1, A–4, or A–6	5–10
			40–74	Channery loam	GM, GC, GM–GC, SM, SC, or SM–SC	A–1, A–2, A–4, or A–6	5–40
*Leck Kill: LkB, LkC, LkD, LlB, LlD, LMF. For Calvin part of LMF, see Calvin series.	>6	3½–6	0–8	Channery silt loam	ML, CL, GM, GC, SM, or SC	A–4	0–10
			8–31	Channery silt loam	ML, CL, GM, GC, SM, or SC	A–4 or A–6	0–10
			31–82	Very channery silt loam, very flaggy loam.	GM, GC, GC–GM, SM, SC, or SM–SC	A–2, A–1, or A–4	0–20
Leetonia: LtB	>6	3½–4	0–13	Flaggy loamy sand	SM, SW–SM, GM, or GW–GM	A–1, A–2, or A–3	35–50
			13–28	Flaggy loamy sand	SM, SW–SM, GM, or GW–GM	A–1, A–2, or A–3	35–50
			28–46	Very flaggy loamy sand.	GW, GM, GW–GM, SW, SM, or SW–SM	A–1	30–40
			46	Sandstone bedrock.			

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.073 mm)							Uncoated steel	Concrete
				In/hr	*In/in of depth*	*pH*	*Pct*	*Lb/cu ft*			
85–100	80–100	75–95	70–95	0.6–2.0	0.14–0.20	4.5–5.5			Low	Moderate	High.
85–100	80–100	75–95	70–95	0.6–2.0	0.12–0.16	4.5–5.5	14–19	105–114	Moderate	High	High.
70–95	60–90	55–85	45–80	0.06–0.6	0.08–0.12	4.5–5.5	12–17	106–120	Moderate	High	High.
75–95	70–90	65–85	55–80	0.6–2.0	0.12–0.18	4.0–5.5			Low	Low	High.
60–85	55–85	45–75	40–70	0.6–2.0	0.10–0.16	4.0–5.5	12–17	106–118	Low	Low	High.
30–55	25–50	20–45	15–40	0.6–2.0	0.06–0.10	4.0–5.5	11–15	112–122	Low	Low	High.
85–100	80–100	80–100	75–100	0.6–2.0	0.16–0.20	5.1–7.3			Low	Moderate	Low.
90–100	80–100	75–100	70–100	0.6–2.0	0.12–0.14	5.1–7.3	18–26	90–107	Moderate	High	Low.
85–100	80–100	75–100	70–100	0.6–2.0	0.10–0.14	5.1–7.3	18–26	90–107	Moderate	High	Low.
60–85	50–80	50–70	35–55	2.0–6.0	0.10–0.16	4.0–5.5			Low	Low	High.
60–85	55–80	50–70	20–55	2.0–>6.0	0.06–0.10	4.0–5.5	8–12	118–128	Low	Low	High.
35–70	25–60	15–45	5–35	2.0–>6.0	0.04–0.08	4.0–5.5	8–12	118–128	Low	Low	High.
95–100	80–10	80–100	75–95	0.6–2.0	0.16–0.20	5.1–6.5			Low	Moderate	Moderate.
75–100	70–100	70–95	55–85	0.6–2.0	0.12–0.16	5.1–6.5	16–24	95–112	Moderate	High	Moderate.
85–100	70–95	65–95	60–85	0.6–2.0	0.12–0.16	5.1–6.5	17–25	93–110	Moderate	High	Moderate.
65–90	55–80	50–80	35–70	0.6–6.0	0.08–0.12	4.5–5.5			Low	Moderate	High.
70–95	60–85	40–75	20–45	0.6–2.0	0.08–0.12	4.5–5.5	12–18	106–120	Low	Moderate	High.
60–85	45–80	40–60	15–40	0.2–0.6	0.06–0.10	4.5–5.5	12–18	106–120	Low	Moderate	High.
65–95	60–90	55–85	45–80	2.0–6.0	0.14–0.20	4.5–6.0			Low	Low	Moderate.
60–90	50–85	45–80	40–70	2.0–6.0	0.12–0.16	4.5–6.0	11–16	110–112	Low	Low	Moderate.
30–70	20–65	15–55	15–40	2.0–6.0	0.04–0.08	4.5–6.0	9–14	114–126	Low	Low	Moderate.
45–85	35–70	20–55	5–20	2.0–6.0	0.03–0.05	4.0–5.0			Low	Moderate	High.
45–85	35–70	20–55	5–20	2.0–6.0	0.03–0.05	4.0–5.0	8–13	114–128	Low	Low	High.
45–60	35–50	20–35	2–15	>6.0	0.02–0.03	4.0–5.0	8–12	116–128	Low	Low	High.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Ft	*Ft*	*In*				*Pct*
Leetonia variant: LvB, LvC.	>6	>6	0–12	Sand	SM or SW–SM	A–2	0–10
			12–60	Loamy sand, sandy loam.	SM or SW–SM	A–2	0–30
Lindside: Lx	1½–3	>6	0–11	Silt loam	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	
			11–41	Silt loam, silty clay loam.	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	
			41–60	Loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4, A–6, A–2, or A–7	
Markes: MaB	0–½	1½–3½	0–9	Silt loam	ML, CL, or CL–ML	A–4 or A–6	
			9–29	Shaly silt loam, very shaly silt loam.	GM, GC, GM–GC, SM, SC, or SM–SC	A–2, A–1, A–4, or A–6	0–10
			29	Shale bedrock (weathered).			
Meckesville MeB, MeC, MkB, MkD.	>6	>6	0–7	Silt loam	ML, CL, or CL–ML	A–4	0–10
			7–28	Heavy silt loam	ML, CL, or CL–ML	A–4 or A–6	0–15
			28–80	Channery silt loam, very channery silt loam.	GM, GC, SM, SC, ML, or CL	A–4 or A–2	0–40
Melvin: Mm	0–½	>6	0–52	Silt loam, silty clay loam.	ML, CL, or CL–ML	A–4 or A–6	
			52–60	Loam	ML, CL, or CL–ML	A–4 or A–6	
Millheim: MnB, MnC, MnD.	>6	3½–6	0–9	Silt loam	ML, CL, or CL–ML	A–4 or A–6	
			9–34	Silty clay	ML, CL, CL–ML, MH, CH, or MH–CH	A–6, A–7, A–4, or A–5	
			34–42	Silty clay	ML, CL, CL–ML, MH, CH, or MH–CH, SC	A–6, A–7, A–5, or A–4	
			42	Shale bedrock (weathered).			
Monongahela: MoB.	1½–3	>6	0–9	Silt loam	ML, CL, or CL–ML	A–4, A–6, A–5, or A–7	0–5
			9–29	Silty clay loam	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	0–10
			29–60	Gravelly clay loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4, A–6, A–7, or A–5	0–10
Morrison: MrB, MrC, MrD, MsB, MsD, MTF.	>6	>6	0–14	Loamy sand, sandy loam.	SM, SC, SM–SC, ML, CL, or CL–ML	A–2 or A–4	0–5
			14–53	Sandy loam, channery sandy clay loam.	SM, SC, SM–SC, ML, CL, or CL–ML	A–2 or A–4	0–10
			53–74	Channery sandy loam.	SM, SC, or SM–SC	A–2 or A–4	0–15
Murrill: MuA, MuB, MuC, MuD, MvB, MvD.	>6	>6	0–11	Channery silt loam	ML, CL, GM, GC, SM, or SC	A–4 or A–6	0–5
			11–41	Channery loam, channery clay loam.	ML, CL, CL–ML, MH, CH, or MH–CH	A–4 or A–6	0–15
			41–67	Clay	CH, MH, MH–CH, ML, CL, or CL–ML	A–4, A–5, A–6, or A–7	

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.073 mm)							Uncoated steel	Concrete
				In/hr	*In/in of depth*	*pH*	*Pct*	*Lb/cu ft*			
90–100	80–100	65–100	10–35	>6.0	0.02–0.05	4.0–5.0			Low	Low	High.
90–100	70–100	65–100	10–25	>6.0	0.02–0.03	4.0–5.0	8–12	112–128	Low	Low	High.
100	95–100	90–100	70–95	0.6–2.0	0.18–0.26	5.6–6.5			Low	Moderate	Moderate.
100	95–100	85–100	60–95	0.6–2.0	0.18–0.22	5.6–6.5	14–18	106–114	Low	High	Moderate.
95–100	85–100	60–95	30–95	0.6–6.0	0.12–0.18	5.6–6.5	12–16	110–118	Low	Moderate	Moderate.
90–100	60–100	60–100	55–95	0.6–2.0	0.14–0.18	4.5–6.0			Low	High	Moderate.
35–75	25–55	20–50	15–45	0.06–0.2	0.08–0.12	4.5–6.0	14–19	104–114	Moderate	High	Moderate.
80–100	75–95	70–85	55–70	0.6–2.0	0.14–0.18	4.0–5.0			Low	Low	High.
65–100	65–95	60–90	55–70	0.6–2.0	0.12–0.14	4.0–5.0	12–18	106–118	Low	Low	High.
45–95	40–90	35–85	30–65	0.2–0.6	0.08–0.12	4.0–5.0	11–16	110–122	Low	Moderate	High.
95–100	90–100	80–100	65–95	0.6–2.0	0.18–0.23	6.1–7.8	16–20	100–110	Low	High	Low.
85–100	80–100	70–100	60–95	0.6–2.0	0.12–0.18	6.1–7.8	14–20	100–114	Low	High	Low.
85–100	70–100	70–100	65–100	0.6–6.0	0.14–0.18	4.5–6.5			Moderate	Moderate	Moderate.
75–100	65–100	65–100	60–100	0.6–2.0	0.08–0.12	4.5–7.3	20–28	90–102	Moderate	High	Moderate.
70–100	50–100	50–100	45–100	0.6–2.0	0.06–0.12	5.6–7.3	20–30	88–102	Moderate	High	Moderate.
90–100	85–100	75–100	60–90	0.6–2.0	0.18–0.24	4.5–5.5			Low	Moderate	High.
90–100	85–100	80–100	70–90	0.6–2.0	0.14–0.18	4.5–5.5	14–18	106–115	Low	High	High.
80–100	70–100	65–90	45–85	0.2–0.6	0.08–0.12	4.5–5.5	12–16	110–120	Low	High	High.
95–100	90–100	60–80	25–55	2.0–6.0	0.12–0.16	4.0–5.5			Low	Low	High.
80–100	70–100	55–80	25–55	2.0–6.0	0.08–0.10	4.0–6.0	10–15	112–124	Low	Low	High.
80–100	70–100	55–80	10–45	2.0–6.0	0.06–0.10	5.1–6.0	9–13	115–126	Low	Low	Moderate.
60–80	55–70	40–65	40–65	0.6–2.0	0.12–0.16	4.5–5.5			Low	Moderate	High.
65–85	60–80	55–75	50–65	0.6–2.0	0.10–0.14	4.5–5.5	13–19	104–115	Low	Moderate	High.
95–100	95–100	60–100	60–100	0.6–2.0	0.08–0.12	4.5–5.5	18–26	88–106	Low	High	High.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Ft	*Ft*	*In*				*Pct*
Nolin: No	>3	>6	0–9	Silt loam	ML, CL, or CL–ML	A–4 or A–6	
			9–78	Silt loam, silty clay loam.	ML, CL, or CL–ML	A–4 or A–6	
*Opequon: OhB, OhC, OhD, ORF, OxB, OxD. For Hagerstown part of OhB, OhC, OhD, and ORF, see Hagerstown series. Rock outcrop part of OxB and OxD, not rated because it is areas of exposed bedrock.	>6	1–1½	0–9	Silty clay loam	ML, CL, or CL–ML	A–6, A–4, A–7, or A–5	0–5
			9–17	Silty clay	CH, MH, MH–CH, CL, or CL–ML	A–7 or A–6	0–10
			17	Fractured limestone bedrock.			
*Philo: Ph, Pk. For Atkins part of Pk, see Atkins series.	1½–3	>6	0–13	Loam	ML, CL, or CL–ML	A–4	0–10
			13–36	Loam	ML, CL, CL–ML, SM, SC, or SM–SC	A–4	0–10
			36–62	Gravelly loam	ML, CL, SM, SC, GM, or GC	A–2 or A–4	0–10
Pope: Po	>3	>6	0–10	Loam	ML or CL–ML	A–4	0–5
			10–38	Loam	ML, CL–ML, SM, or SM–SC	A–4	0–5
			38–60	Gravelly sandy loam	SM, SM–SC, GM, or GM–GC	A–2, A–1, or A–4	0–5
Purdy: Pu	0–½	>6	0–6	Silt loam	ML, CL, or CL–ML	A–4, A–5, A–6, or A–7	
			6–45	Silty clay loam, silty clay.	CL, ML, or CL–ML	A–4, A–6, A–7, or A–5	
			45–62	Silty clay	ML, CL, or CL–ML	A–4, A–6, A–5, or A–7	0–10
Rayne: RaB	>6	3½–6	0–6	Silt loam	ML, CL, or CL–ML	A–4 or A–6	0–5
			6–40	Shaly silty clay loam	ML, CL, GM, GC, SM, or SC	A–4, A–6, or A–7	0–10
			40–60	Very shaly silt loam	GM, GC, SM, SC, ML, or CL	A–2, A–4, A–1, or A–6	0–50
Rubble land: Ru. Too variable to rate. Onsite investigation required.							
Strip mines: Sm. Too variable to rate. Onsite investigation required.							
Tyler: Ty	½–1½	>6	0–11	Silt loam	ML, CL, or CL–ML	A–4	
			11–44	Heavy silt loam, silty clay loam.	ML, CL, or CL–ML	A–6, A–7, A–4, or A–5	
			44–60	Clay loam, loamy sand.	ML, CL, CL–ML, SM, SC, or SM–SC	A–4, A–6, A–7, or A–5	

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.073 mm)							Uncoated steel	Concrete
				In/hr	*In/in of depth*	*pH*	*Pct*	*Lb/cu ft*			
100	95–100	90–100	80–100	0.6–2.0	0.18–0.23	5.6–7.3			Low	Low	Moderate.
100	95–100	85–100	75–100	0.6–2.0	0.18–0.23	5.6–7.3	15–20	100–115	Low	Moderate	Moderate.
85–100	80–100	80–100	75–90	0.6–2.0	0.16–0.20	5.6–7.3			Moderate	Moderate	Low.
80–10	70–100	70–100	65–95	0.6–2.0	0.12–0.16	5.6–7.3	16–26	88–112	High	High	Low.
95–100	80–100	70–90	55–80	0.6–2.0	0.12–0.20	4.5–6.0			Low	Moderate	High.
95–100	80–100	70–90	45–80	0.6–2.0	0.12–0.20	4.5–6.0	10–16	110–124	Low	Moderate	High.
60–95	50–90	40–80	30–75	2.0–6.0	0.06–0.10	4.5–6.0	8–12	115–125	Low	Moderate	High.
85–100	80–100	65–85	50–65	2.0–6.0	0.12–0.16	4.0–5.5			Low	Low	High.
75–100	60–100	55–80	40–60	2.0–6.0	0.12–0.16	4.0–5.5	10–14	110–120	Low	Low	High.
50–80	45–75	35–55	20–45	2.0–6.0	0.06–0.10	4.0–5.5	8–12	118–128	Low	Low	High.
95–100	90–100	90–100	90–100	0.6–2.0	0.18–0.24	4.0–5.5			Moderate	High	High.
95–100	90–100	85–100	75–95	0.06–0.2	0.12–0.16	4.0–5.5	16–22	98–110	Moderate	High	High.
95–100	90–100	85–95	70–95	0.06–0.2	0.10–0.14	4.0–5.5	14–20	100–114	Moderate	High	High.
85–100	80–90	70–85	60–80	0.6–2.0	0.14–0.18	4.5–5.5			Low	Low	High.
60–95	50–85	40–85	35–60	0.6–2.0	0.12–0.16	4.5–5.5	14–18	106–114	Low	Moderate	High.
40–90	30–80	30–70	20–60	0.6–2.0	0.10–0.16	4.5–5.5	12–16	110–118	Low	Low	High.
95–100	90–100	90–100	85–100	0.6–2.0	0.18–0.22	4.0–5.5			Low	High	High.
95–100	90–100	85–100	75–90	0.06–0.2	0.10–0.14	4.0–5.5	14–20	100–114	Moderate	High	High.
90–100	85–100	75–95	45–80	0.06–2.0	0.10–0.14	4.0–5.5	12–16	106–118	Moderate	High	High.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Ft	*Ft*	*In*				*Pct*
Ungers: UmB, UmC, UmD, UnB, UnD.	>6	3½–6½	0–6	Channery loam	SM, SC, GM, GC, ML, or CL	A–4 or A–2	0–10
			6–31	Channery loam, sandy clay loam, channery sandy clay loam.	SM, SC, GM, GC, ML, or CL	A–2 or A–4	0–10
			31–61	Very channery sandy loam.	GM, GC, GM–GC, SM, SC, or SM–SC	A–1 or A–2	0–15
*Urban land: URB. Too variable to rate. Onsite investigation required. For Hagerstown part, see Hagerstown series.							
Vanderlip: VaC.	>6	>8	0–22	Loamy sand	SM	A–2 or A–1	0–5
			22–60	Channery loamy sand	SM, SW, SW–SM, GM, GW, or GW–GM	A–2, A–3, or A–1	0–10
Weikert: WeC, WeD.	>6	1–1½	0–7	Shaly silt loam, very shaly silt loam.	GM, GC, SM, SC, ML, or CL	A–1, A–2, or A–4	0–10
			7–17	Very shaly silt loam	GM, GC, GW–GM, SM, SC, or SW–SM	A–1 or A–2	0–20
			17	Fractured shale bedrock.			
Wharton: WhA, WhB, WhC.	1½–3	3½–>6	0–12	Silt loam	ML, CL, or CL–ML	A–4, A–6, A–7, or A–5	0–5
			12–49	Silty clay loam, clay loam, shaly clay loam.	ML, CL, CL–ML, MH, CH, or MH–CH	A–7, A–6, A–4, or A–5	0–10
			49–74	Shaly clay loam	ML, CL, GM, GC, SM, or SC	A–4, A–6, A–7, or A–5	0–20
Wyoming: WyA	>3	>6	0–13	Gravelly sandy loam	SM, SW–SM, GM, or GW–GM	A–1 or A–2	0–15
			13–64	Very gravelly sandy loam.	SM, SW–SM, GM, or GW–GM	A–1 or A–2	0–25

A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage. They also reflect the relative ease of excavating the material at borrow areas.

Soil properties that most affect highway and road location are load supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and also the shrink-swell potential indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rock fragments, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.073 mm)							Uncoated steel	Concrete
				In/hr	*In/in of depth*	*pH*	*Pct*	*Lb/cu ft*			
65–95	60–90	45–70	30–55	0.6–2.0	0.10–0.16	4.0–5.5			Low	Low	High.
60–95	55–90	40–70	25–55	0.6–2.0	0.10–0.14	4.0–5.5	9–14	114–125	Low	Moderate	High.
55–85	25–50	20–40	15–30	2.0–6.0	0.06–0.12	4.0–5.5	8–12	118–128	Low	Low	High.
65–100	45–95	25–55	15–25	>6.0	0.08–0.12	4.5–6.0	8–13	114–128	Low	Low	High.
45–100	25–100	15–75	2–30	>6.0	0.06–0.10	4.5–6.0	8–13	114–128	Low	Low	High.
40–70	35–70	25–65	20–55	2.0–6.0	0.08–0.14	4.5–5.5			Low	Low	High.
15–60	10–45	5–35	5–35	2.0–6.0	.04–0.08	4.5–5.5	10–14	114–124	Low	Low	High.
95–100	90–100	80–95	70–95	0.6–2.0	0.16–0.20	4.5–5.5			Low	Moderate	High.
80–100	75–100	70–95	60–90	0.2–0.6	0.12–0.16	4.5–5.5	16–22	98–100	Moderate	High	High.
60–100	50–100	45–95	40–90	0.2–0.6	0.08–0.12	4.0–5.0	14–18	106–114	Moderate	High	High.
40–80	30–60	10–50	10–35	>6.0	0.06–0.10	4.0–6.0			Low	Low	High.
40–65	25–60	5–50	5–20	>6.0	0.04–0.06	4.0–6.0	8–12	118–128	Low	Low	High.

Embankments and dikes require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; and availability of outlets for drainage.

Sprinkler irrigation of a soil is affected by such features as slope; susceptibility to stream overflow or water erosion; texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; need for drainage; and depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

TABLE 8.—*Interpretations for*

[An asterisk in the first column indicates that at least one mapping unit of that series is made up of two or more kinds of soil. The referring to other series that appear in

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir areas	Embankments
Albrights: AbB, AbC, AcB, AcC.	Fair on AbB and AbC: small stones. Poor on AcB and AcC: large stones.	Unsuited: excessive fines.	Fair: frost action.	Frost action; large stones on AcB and AcC; seasonal high water table; seepage above fragipan.	Moderately slow permeability.	Fair to good compaction; medium to low strength; large stones on AcB and AcC.
Allegheny: AlB	Fair: small stones.	Poor: excessive fines.	Fair: frost action.	Frost action	Moderate permeability; pervious substratum.	Fair to good compaction; medium strength; susceptible to piping.
Andover: AnB, AnC, AoB, AoC.	Poor: small stones; large stones on AoB and AoC; high water table.	Unsuited: excessive fines.	Poor: high frost action; medium to low strength; high water table.	High water table; frost action; large stones on AoB and AoC; seepage above fragipan.	Slow permeability; high water table.	Fair to good compaction; medium to low strength; large stones on AoB and AoC.
Armagh: ArA, ArB	Poor: high water table.	Unsuited: excessive fines.	Poor: frost action; low strength; high water table.	High water table; frost action; shrink-swell.	Slow permeability; high water table.	Fair to good compaction; low strength.
Atkins: At	Poor: high water table.	Unsuited: excessive fines; locally poor in substratum.	Poor: frost action; high water table.	Floods; frost action; high water table.	Floods; moderately slow and slow permeability; high water table; possible pervious substratum.	Fair compaction; medium strength; susceptible to piping; floods.
Basher: Ba	Fair: small stones.	Poor: excessive fines; locally poor in substratum.	Fair: frost action.	Floods; frost action; seasonal high water table.	Floods; moderate permeability; pervious substratum.	Fair to poor compaction; medium strength; floods; susceptible to piping.
*Berks: BkB, BkC, BkD, BlD, BMF. For Weikert part of BMF, see Weikert series.	Poor: small stones.	Unsuited: excessive fines.	Poor: thin layer.	Rippable bedrock at a depth of 1½ to 3½ feet.	Pervious bedrock at a depth of 1½ to 3½ feet; moderately rapid permeability.	Limited material; bedrock at a depth of 1½ to 3½ feet; medium strength; susceptible to piping; slopes.
Brinkerton: BrA, BrB, BrC, BsB.	Poor: large stones on BsB; high water table.	Unsuited: excessive fines.	Poor: frost action; medium to low strength; high water table.	High water table; frost action; shrink-swell potential; large stones on BsB; seepage above fragipan.	Slow permeability; high water table; large stones on BsB.	Fair to good compaction; medium to low strength.

selected engineering uses

soils in such mapping units may have different properties, and for this reason it is necessary to follow carefully the instructions for the first column of this table]

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces and diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Moderately slow permeability; seasonal high water table; fragipan.	Seasonal high water table; fragipan; moderately slow permeability; large stones on AcB and AcC.	Moderately slow permeability; seasonal high water table; erodes easily.	Erodes easily; seasonal high water table; seepage above fragipan; large stones on AcB and AcC.	Seasonal high water table; forms large frozen clods; large stones on AcC and AcB.	Seasonal high water table; high corrosion potential; large stones on AcC and AcB.
Well drained	Moderate permeability; high available water capacity.	Moderate permeability; erodes easily.	Erodes easily; high available water capacity.	May form large frozen clods; fair trafficability.	Subject to caving.
Slow permeability; high water table; fragipan.	High water table; fragipan; slow permeability; large stones on AoB and AoC.	Slow permeability; erodes easily; high water table.	Erodes easily; seepage above fragipan; large stones on AoB and AoC; high water table.	Forms large frozen clods; high water table; poor trafficability; large stones on AoB and AoC.	High water table; high corrosion potential; large stones on AoB and AoC.
Slow permeability; high water table.	High water table; slow permeability.	Slow permeability; high water table; erodes easily.	Erodes easily; clayey subsoil; high water table.	Forms large frozen clods; high water table; poor trafficability.	High water table; high corrosion potential.
Floods; moderately slow and slow permeability; high water table.	High water table; moderately slow and slow permeability; floods.	High water table; floods.	Floods; high water table.	Floods; high water table; forms large frozen clods.	High water table; high corrosion potential; subject to caving; floods.
Floods; moderate permeability; seasonal high water table.	Seasonal high water table; moderate permeability; floods; high available water capacity.	Seasonal high water table; floods.	Seasonal high water table; floods.	Floods; seasonal high water table; may form large frozen clods.	Seasonal high water table; subject to caving; floods; moderate corrosion potential.
Well drained	Moderately rapid permeability; very low available water capacity.	Rippable bedrock at a depth of 1½ to 3½ feet.	Rippable bedrock at a depth of 1½ to 3½ feet; very low available water capacity.	All features favorable.	Rippable bedrock at a depth of 1½ to 3½ feet.
Slow permeability; high water table; fragipan.	High water table; slow permeability; fragipan; large stones on BsB.	Slow permeability; erodes easily; high water table.	Erodes easily; seepage above fragipan; large stones on BsB; high water table.	Forms large frozen clods; poor trafficability; large stones on BsB; high water table.	High water table; high to moderate corrosion potential; large stones on BsB.

TABLE 8.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir areas	Embankments
Buchanan: BtB, BuB, BuC, BxB, BxD.	Poor: small stones; large stones on BxB and BxD.	Unsuited: excessive fines.	Fair: frost action; large stones on BxB and BxD.	Frost action; large stones on BxB and BxD; seasonal high water table; seepage above fragipan.	Slow permeability.	Fair to good compaction; medium strength; large stones on BxB and BxD.
Calvin ---------- Mapped only with Leck Kill soils.	Poor: small stones.	Poor: excessive fines.	Poor: thin layer.	Rippable bedrock at a depth of 1½ to 3½ feet; steep.	Pervious bedrock at a depth of 1½ to 3½ feet; moderately rapid permeability.	Limited material; bedrock at a depth of 1½ to 3½ feet; medium strength; susceptible to piping.
Carlisle: CA ------	Poor: organic material; high water table.	Unsuited: organic material.	Unsuited: organic material; shrink-swell; frost action.	Organic material; frost action; shrink-swell; unstable; floods; high water table.	Organic material; floods; high water table; moderately rapid permeability.	Unstable organic material; poor compaction; low strength.
Cavode: CdA, CdB --	Fair: thin layer; small stones.	Unsuited: excessive fines.	Poor: frost action; low strength.	Frost action; seasonal high water table; shrink-swell.	Slow permeability; seasonal high water table.	Fair to good compaction; low strength.
Chagrin: Ch ------	Good ----------	Unsuited: excessive fines.	Fair: frost action; low strength.	Floods; frost action.	Floods; moderate permeability; pervious substratum.	Susceptible to piping; fair to poor compaction; floods.
Clarksburg: CkA, CkB.	Good ----------	Unsuited: excessive fines.	Fair: frost action; low strength.	Frost action; shrink-swell; seasonal high water table.	Slow permeability; seasonal high water table.	Fair to good compaction; low strength; susceptible to piping.
Clymer: ClB, ClC, CvB, CvD.	Fair on ClB and ClC: small stones. Poor on CvB and CvD: large stones.	Poor: excessive fines.	Good ----------	Large stones on CvB and CvD.	Moderately rapid permeability; slope.	Fair compaction; large stones on CvB and CvD; medium permeability when compacted.
Dekalb ---------- Mapped only with Hazleton soils.	Poor: small and large stones.	Poor: excessive fines.	Poor: thin layer.	Hard bedrock at depth of 1½ to 3½ feet; steep; large stones.	Moderately rapid permeability; pervious bedrock at a depth of 1½ to 3½ feet.	Limited material; hard bedrock at a depth of 1½ to 3½ feet; large stones; susceptible to piping.
Dunning: Du ------	Poor: high water table.	Unsuited: excessive fines.	Poor: frost action; low strength; high water table.	Floods; high water table; frost action; shrink-swell; low strength.	Floods; slow permeability; high water table; possible pervious substratum.	Low strength; floods; poor compaction; high compressibility.

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces and diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Slow permeability; seasonal high water table; fragipan.	Seasonal high water table; slow permeability; fragipan; large stones on BxB and BxD.	Slow permeability; seasonal high water table; large stones on BxB and BxD.	Seasonal high water table; seepage above fragipan; large stones on BxB and BxD.	Seasonal high water table; forms large frozen clods; large stones on BxB and BxD.	Seasonal high water table; moderate corrosion potential; large stones on BxB and BxD.
Well drained	Low to moderate available water capacity; moderately rapid permeability.	Rippable bedrock at a depth of 1½ to 3½ feet.	Rippable bedrock at a depth of 1½ to 3½ feet; low to moderate available water capacity.	All features favorable.	Rippable bedrock at a depth of 1½ to 3½ feet.
Floods; organic material; moderately rapid permeability; high water table.	High water table; organic material; high available water capacity; floods.	Unstable organic material; high water table.	Floods; organic material; high water table.	Floods; high water table; forms large frozen clods; organic material; poor trafficability.	High water table; high corrosion potential; subsidence; organic material.
Slow permeability; seasonal high water table.	Seasonal high water table; slow permeability.	Slow permeability; seasonal high water table; erodes easily.	Erodes easily; seasonal high water table.	Forms large frozen clods; poor trafficability; seasonal high water table.	Seasonal high water table; high corrosion potential.
Floods; well drained.	Floods; high available water capacity; moderate permeability.	Floods	Floods	May form large frozen clods; floods.	Subject to caving; floods.
Slow permeability; seasonal high water table; fragipan.	Seasonal high water table; slow permeability; fragipan.	Slow permeability; erodes easily; seasonal high water table.	Erodes easily; seepage above fragipan; seasonal high water table.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; moderate corrosion potential.
Well drained	Moderately rapid permeability; moderate available water capacity; large stones on CvB and CvD.	Moderately rapid permeability; large stones on CvB and CvD.	Erodes easily; large stones on CvB and CvD.	Forms large frozen clods in places; large stones on CvB and CvD; fair compaction.	Large stones on CvB and CvD; moderate corrosion potential.
Well drained	Very low and low available water capacity; moderately rapid permeability; large stones.	Hard bedrock at a depth of 1½ to 3½ feet; large stones.	Hard bedrock at a depth of 1½ to 3½ feet; low and very available water capacity; large stones.	Large stones	Hard bedrock at a depth of 1½ to 3½ feet; large stones.
Floods; slow permeability; high water table.	High water table; slow permeability; floods.	Floods; high water table.	Floods; high water table.	Floods; forms large frozen clods; poor trafficability.	High water table; high corrosion potential; subject to caving; floods.

TABLE 8.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir areas	Embankments
Edom: EdB, EdC, EdD.	Fair: small stones; too clayey.	Unsuited: excessive fines.	Poor: low strength.	Frost action; shrink-swell; low strength.	Moderate permeability; slope.	Low strength; high compressibility; poor compaction.
Ernest: ErB, ErC, ErD, EvB, EvD.	Poor: small stones; large stones on EvB and EvD.	Unsuited: excessive fines.	Fair: frost action.	Frost action; large stones on EvB and EvD; shrink-swell; seasonal high water table.	Moderately slow and slow permeability; seasonal high water table.	Medium and low strength; fair and good compaction; large stones on EvB and EvD.
Gilpin: GlB, GlC, GlD.	Poor: small stones.	Unsuited: excessive fines.	Poor: thin layer.	Rippable bedrock at a depth 1½ to 3½ feet; frost action.	Pervious bedrock at depth of 1½ to 3½ feet; moderate permeability.	Limited material; rippable bedrock at a depth of 1½ to 3½ feet; susceptible to piping.
Hagerstown: HaA, HaB, HaC, HcB, HcC, HcD.	Fair: difficult to revegetate borrow areas.	Unsuited: excessive fines.	Poor: low strength.	Frost action; shrink-swell; low strength; sinkholes.	Moderate permeability; sinkholes.	Low strength; high compressibility; fair and poor compaction.
*Hazleton: HhB, HhC, HhD, HSB, HSD, HTF. For Dekalb part of HTF, see Dekalb series.	Poor: small stones; large stones on HSB, HSD, and HTF.	Poor: excessive fines; large stones.	Good on HhB, HhC, and HhD. Fair on HSB, HSD, and HTF: large stones.	Large stones on HSB, HSD, and HTF.	Moderately rapid and rapid permeability.	Medium and high permeability when compacted; large stones on HSB, HSD, and HTF; susceptible to piping.
Hublersburg: HuA, HuB, HuC, HuD.	Fair: small stones; difficult to vegetate borrow areas.	Unsuited: excessive fines.	Poor: low strength.	Frost action; shrink-swell; sinkholes; low strength.	Moderate permeability; sinkholes.	Low strength; high compressibility; fair and poor compaction.
Laidig: LaB, LaC, LaD, LcB, LcD, LDF.	Poor: small stones on LaB, LaC, LaD; large stones on LcB, LcD, and LDF.	Unsuited: excessive fines.	Good on LaB, LaC, and LaD. Fair on LcB, LcD, and LDF: large stones.	Large stones on LcB, LcD, LDF; seepage above fragipan.	Moderately slow permeability.	Fair and good compaction; large stones on LcB, LcD, and LDF.
*Leck Kill: LkB, LkC, LkD, LlB, LlD, LMF. For Calvin part of LMF, see Calvin series.	Poor: small stones on LkB, LkC, and LkD; large stones on LlB, LlD, and LMF.	Unsuited: excessive fines.	Fair: frost action.	Large stones on LlB, LlC, and LMF; frost action; rippable bedrock at a depth of 3½ to 6 feet.	Moderately rapid permeability.	Fair and good compaction; large stones on LlB, LlC, and LMF.
Leetonia: LtB	Poor: large stones; too sandy.	Fair: excessive fines.	Fair: large stones.	Large stones; hard bedrock at a depth of 3½ to 4 feet.	Moderately rapid permeability; pervious bedrock at a depth of 3½ to 4 feet.	Susceptible to piping; high permeability when compacted; large stones; hard bedrock at a depth of 3½ to 4 feet.

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces and diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Well drained	Moderate permeability; moderate and high available water capacity.	Moderate permeability; erodes easily; clayey subsoil.	Erodes easily; moderate and high available water capacity; clayey subsoil; sinkholes.	Forms large frozen clods; poor compaction.	High corrosion potential; clayey subsoil; sinkholes.
Moderately slow and slow permeability; seasonal high water table; fragipan.	Seasonal high water table; moderately slow and slow permeability; fragipan, large stones on EvB and EvD; slope.	Moderately slow and slow permeability; seasonal high water table; large stones on EvB and EvD.	Seasonal high water table; seepage above fragipan; large stones on EvB and EvD; erodes easily.	Seasonal high water table; forms large frozen clods; large stones on EvB and EvD.	Seasonal high water table; moderate corrosion potential; large stones on EvB and EvD.
Well drained	Moderate permeability; low and moderate available water capacity.	Rippable bedrock at a depth of 1½ to 3½ feet; moderate permeability.	Rippable bedrock at a depth of 1½ to 3½ feet; erodes easily; low and moderate available water capacity.	Forms large frozen clods in places; fair and good compaction.	Rippable bedrock at a depth of 1½ to 3½ feet.
Well drained	Moderate permeability; high available water capacity.	Moderate permeability; erodes easily; clayey subsoil.	Erodes easily; high available water capacity; clayey subsoil; sinkholes.	Forms large frozen clods; fair and poor compaction.	High corrosion potential; clayey subsoil; sinkholes.
Well drained	Moderately rapid and rapid permeability; low and moderate available water capacity; large stones on HSB, HSD, and HTF.	Moderately rapid and rapid permeability; large stones on HSB, HSD, and HTF.	Erodes easily; low and moderate available water capacity; large stones on HSB, HSD, and HTF.	Large stones on HSB, HSD, and HTF.	Large stones on HSB, HSD, and HTF.
Well drained	Moderate permeability; high available water capacity; slope.	Moderate permeability; erodes easily; clayey subsoil.	Erodes easily; high available water capacity; clayey subsoil; sinkholes.	Forms large frozen clods; fair and poor compaction.	High corrosion potential; clayey subsoil; sinkholes.
Well drained	Moderately slow permeability; fragipan; large stones on LcB, LcD, and LDF.	Moderately slow permeability; large stones on LcB, LcD, and LDF.	Large stones on LcB, LcD, and LDF.	Large stones on LcB, LcD, and LDF; fair to good compaction.	Moderate corrosion potential; large stones on LcB, LcD, and LDF.
Well drained	Moderately rapid permeability; moderate and high available water capacity; large stones on LIB, LIC, and LMF.	Moderately rapid permeability; large stones on LIB, LIC, and LMF; erodes easily.	Erodes easily; large stones on LIC, LID, and LMF; moderate and high available water capacity.	Forms large frozen clods in places; large stones on LIB, LIC, and LMF.	Large stones on LIB, LIC, and LMF.
Well drained	Moderately rapid permeability; very low available water capacity; large stones.	Moderately rapid permeability; large stones; hard bedrock at a depth of 3½ to 4 feet.	Very low available water capacity; hard bedrock at a depth of 3½ to 4 feet; large stones.	Large stones; good trafficability.	Large stones; hard bedrock at a depth of 3½ to 4 feet.

TABLE 8.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir areas	Embankments
Leetonia variant: LvB, LvC.	Poor: too sandy.	Fair: excessive fines.	Good	Erodes easily	Rapid permeability.	Susceptible to piping; high permeability when compacted.
Lindside: Lx	Good	Unsuited: excessive fines.	Fair: frost action.	Floods; frost action; low strength; seasonal high water table.	Floods; moderate permeability; pervious substratum.	Fair compaction; susceptible to piping; floods.
Markes: MaB	Poor: high water table.	Unsuited: excessive fines.	Poor: high frost action; thin layer; high water table.	Frost action; shrink-swell; rippable bedrock at a depth of 1½ to 3½ feet; high water table.	Slow permeability; rippable bedrock at a depth of 1½ to 3½ feet; high water table.	Limited material; rippable bedrock at a depth of 1½ to 3½ feet; fair and good compaction.
Meckesville: MeB, MeC, MkB, MkD.	Fair on MeB and MeC: small stones; slope. Poor on MkB and MkD: large stones.	Unsuited: excessive fines.	Fair: frost action.	Large stones on MkB and MkD; frost action.	Moderately slow permeability.	Fair and good compaction; medium and low strength; large stones on MkB and MkD.
Melvin: Mm	Poor: high water table.	Unsuited: excessive fines.	Poor: frost action; high water table.	Floods; high water table; frost action.	Moderate permeability; high water table; floods; possible pervious substratum.	Fair compaction; medium and low strength; susceptible to piping; floods.
Millheim: MnB, MnC, MnD.	Fair: too clayey.	Unsuited: excessive fines.	Poor: low strength.	Frost action; shrink-swell; low strength.	Moderate permeability.	Low strength; high compressibility; poor compaction.
Monogahela: MoB	Fair: small stones.	Unsuited: excessive fines.	Fair: frost action.	Frost action; seasonal high water table.	Moderately slow permeability; possible pervious substratum.	Fair and good compaction; medium and low strength; susceptible to piping.
Morrison: MrB, MrC, MrD, MsB, MsD, MTF.	Fair on MrB, MrC, and MrD: small stones. Poor on MsB, MsD, and MTF: large stones.	Unsuited: excessive fines.	Fair: frost action.	Frost action; large stones on MsB, MsD, and MTF.	Moderately rapid permeability.	Susceptible to piping; medium permeability when compacted; large stones on MsB, MsD, and MTF.
Murrill: MuA, MuB, MuC, MuD, MvB, MvD.	Poor: small stones; large stones on MvB and MvD.	Unsuited: excessive fines.	Poor: low strength.	Frost action; sinkholes; large stones on MvB and MvD; low strength.	Moderate permeability; sinkholes.	Low strength; susceptible to piping; high compressibility; fair or poor compaction.

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces and diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Well drained	Rapid permeability; very low available water capacity.	Rapid permeability; erodes easily.	Erodes easily; very low available water capacity.	All features favorable.	Subject to caving.
Floods; moderate permeability; seasonal high water table.	Seasonal high water table; moderate permeability; floods; high available water capacity.	Floods; seasonal high water table.	Seasonal high water table; floods.	Floods; seasonal high water table; forms large clods in places.	Seasonal high water table; subject to caving; moderate corrosion potential; floods.
Slow permeability; rippable bedrock at a depth of 1½ to 3½ feet; high water table.	High water table; slow permeability; low and moderate available water capacity; rippable bedrock at a depth of 1½ to 3½ feet.	Slow permeability; erodes easily; rippable bedrock at a depth of 1½ to 3½ feet.	Rippable bedrock at a depth of 1½ to 3½ feet; erodes easily; low and moderate available water capacity; high water table.	Forms large frozen clods; poor trafficability; high water table.	High water table; high corrosion potential; rippable bedrock at a depth 1½ to 3½ feet.
Moderately slow permeability; fragipan.	Moderately slow permeability; fragipan; large stones on MkB and MkD.	Moderately slow permeability; large stones on MkB and MkD; erodes easily.	Erodes easily; large stones on MkB and MkD.	Forms large frozen clods in places; large stones on MkB and MkD.	Moderate corrosion potential; large stones on MkB and MkD.
Floods; moderate permeability; high water table.	High water table; moderate permeability; floods.	Floods; high water table.	Floods; high water table.	Floods; high water table; forms large frozen clods.	High water table; high corrosion potential; subject to caving; floods.
Well drained	Moderate permeability; moderate available water capacity; slope.	Moderate permeability; erodes easily; clayey subsoil.	Erodes easily; moderate available water capacity; clayey subsoil.	Forms large frozen clods; poor compaction.	High corrosion potential.
Moderately slow permeability; seasonal high water table; fragipan.	Seasonal high water table; moderately slow permeability; fragipan.	Moderately slow permeability; seasonal high water table; erodes easily.	Erodes easily; seasonal high water table; seepage above fragipan.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; high corrosion potential; subject to caving.
Well drained	Moderately rapid permeability; moderate available water capacity; large stones on MsB, MsD, and MTF.	Moderately rapid permeability; large stones on MsB, MsD, and MTF; erodes easily.	Erodes easily; moderate available water capacity; large stones on MsB, MsD, and MTF.	Large stones on MsB, MsD, and MTF.	Large stones on MsB, MsD, and MTF.
Well drained	Moderate permeability; moderate and high available water capacity; large stones on MvB and MvD.	Moderate permeability; erodes easily; clayey subsoil; sinkholes; large stones on MvB and MvD.	Erodes easily; moderate and high available water capacity; clayey subsoil; large stones on MvB and MvD.	Forms large frozen clods in places; large stones on MvB and MvD; fair or poor compaction.	Moderate corrosion potential; clayey subsoil; sinkholes; large stones on MvB and MvD.

TABLE 8.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir areas	Embankments
Nolin: No	Good	Unsuited: excessive fines.	Fair: frost action.	Frost action; rarely floods.	Moderate permeability; possible pervious substratum.	Fair compaction; susceptible to piping.
*Opequon: OhB, OhC, OhD, ORF, OxB, OxD. For Hagerstown part of OhB, see Hagerstown series; Rock outcrop parts of OxB and OxD not interpreted because they are areas of exposed bedrock.	Poor: too clayey; thin layer.	Unsuited: excessive fines; thin layer.	Poor: low strength; thin layer; shrink-swell.	Shrink-swell; low strength; hard bedrock at a depth of 1 foot to 1½ feet.	Moderate permeability; pervious bedrock at a depth of 1 foot to 1½ feet; sinkholes.	Limited material; hard bedrock at a depth of 1 foot to 1½ feet; low strength; high compressibility; poor compaction.
*Philo: Ph, Pk For Atkins part of Pk, see Atkins series.	Good on Ph. Poor on Pk: large stones.	Poor: excessive fines.	Fair: frost action.	Floods; frost action; large stones on Pk; seasonal high water table.	Floods; moderate permeability; pervious substratum; seasonal high water table.	Floods; fair and poor compaction; medium strength; susceptible to piping.
Pope: Po	Fair: small stones.	Poor: excessive fines.	Fair: frost action; low strength.	Floods; frost action.	Floods; moderately rapid permeability; pervious substratum.	Floods; fair compaction; susceptible to piping.
Purdy: Pu	Poor: high water table.	Unsuited: excessive fines.	Poor: frost action; low strength; high water table.	Frost action; shrink-swell; high water table.	Slow permeability; high water table; possible pervious substratum.	Fair and good compaction; low strength.
Rayne: RaB	Fair: small stones.	Unsuited: excessive fines.	Fair: frost action.	Frost action	Moderate permeability.	Fair compaction; medium strength; susceptible to piping.
Rubble land: Ru	Poor: large stones.	Unsuited: large stones.	Poor: large stones.	Large stones	Pervious substratum.	Large stones; high permeability when compacted.
Strip mines: Sm	Poor: small stones; acid material.	Unsuited: soft shale and siltstone fragments.	Fair: large stones.	Large stones; acid material.	Pervious substratum.	Small and large stones; poor compaction; high permeability when compacted; susceptible to piping.

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces and diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Well drained	Moderate permeability; high available water capacity.	Moderate permeability; erodes easily; rarely floods.	Erodes easily; high available water capacity.	Forms large frozen clods in places.	Subject to caving.
Well drained	Moderate permeability; low available water capacity.	Hard bedrock at a depth of 1 foot to 1½ feet; clayey subsoil; moderate permeability; steep slopes; sinkholes.	Hard bedrock at a depth of 1 foot to 1½ feet; low available water capacity; clayey subsoil; erodes easily; sinkholes.	Forms large frozen clods; poor compaction.	Hard bedrock at a depth of 1 foot to 1½ feet; high corrosion potential; sinkholes; clayey subsoil.
Floods; moderate permeability; seasonal high water table.	Seasonal high water table; moderate permeability; floods; large stones on Pk; moderate and high available water capacity.	Floods; seasonal high water table.	Seasonal high water table; floods.	Floods; seasonal high water table; may form large frozen clods; large stones on Pk.	Seasonal high water table; subject to caving; floods; large stones on Pk; moderate corrosion potential.
Well drained; floods.	Moderately rapid permeability; moderate and high available water capacity; floods.	Floods	Floods	Floods; may form large frozen clods.	Subject to caving; floods.
Slow permeability; high water table.	Slow permeability; high water table.	Slow permeability; wetness; high water table.	High water table	Forms large frozen clods; high water table; poor trafficability.	High corrosion potential; subject to caving; high water table.
Well drained	Moderate permeability; moderate and high available water capacity.	Moderate permeaiblity; erodes easily.	Erodes easily; moderate and high available water capacity.	Forms large frozen clods in places.	All features favorable.
Well drained; large stones.	Large stones	Large stones	Large stones	Large stones; poor trafficability.	Large stones.
Features variable	Acid material; low and very low available water capacity; small and large stones.	Small and large stones; acid material.	Low and very low available water capacity; acid material.	Small and large stones.	High corrosion potential.

TABLE 8.—*Interpretations for*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir areas	Embankments
Tyler: Ty	Good	Unsuited: excessive fines.	Poor: frost action; low strength.	Frost action; low strength; shrink-swell; seasonal high water table.	Slow permeability; seasonal high water table; possible pervious substratum.	Fair compaction; low strength; susceptible to piping.
Ungers: UmB, UmC, UmD, UnB, UnD.	Poor: small stones; large stones on UnB and UnD.	Poor: excessive fines.	Good where slope is less than moderately steep. Fair where slope is moderately steep.	Large stones on UnB and UnD.	Moderate permeability; slope.	Fair compaction; large stones on UnB and UnD; medium permeability when compacted; susceptible to piping.
*Urban land: URB. Too variable to be rated. Onsite investigation required. For Hagerstown part, see Hagerstown series.						
Vanderlip: VaC	Poor: too sandy.	Fair: excessive fines.	Good	Erodes easily	Rapid permeability.	High permeability when compacted; susceptible to piping.
Weikert: WeC, WeD.	Poor: small stones; thin layer.	Poor: excessive fines.	Poor: thin layer.	Rippable bedrock at a depth of 1 foot to 1½ feet.	Pervious bedrock at a depth of 1 foot to 1½ feet; moderately rapid permeability.	Limited material; bedrock at a depth of 1 foot to 1½ feet; high permeability when compacted.
Wharton: WhA, WhB, WhC.	Fair: thin layer.	Unsuited: excessive fines.	Poor: frost action; low strength.	Frost action; shrink-swell; seasonal high water table; low strength.	Moderately slow permeability; seasonal high water table.	Fair and poor compaction; low strength.
Wyoming: WyA	Poor: small stones.	Fair: excessive fines.	Good	Favorable; rarely floods.	Rapid permeability; pervious substratum.	High permeability when compacted; susceptible to piping.

Grassed waterway layout and construction are affected by such soil properties as texture, depth, and erodibility of the soil material; presence of stones or rock outcrop; and the steepness of slopes. Other factors affecting waterways are seepage, natural drainage, available water capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Winter grading is affected chiefly by soil features that are relevant to moving, mixing, and compacting soil in road building when temperatures are below freezing.

Pipeline construction and maintenance and other shallow excavations for sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries are those that generally require digging or trenching to a depth of less than 6 feet. Desirable soil

selected engineering uses—Continued

Soil features affecting—Continued					
Drainage	Sprinkler irrigation	Terraces and diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Slow permeability; seasonal high water table; fragipan.	Seasonal high water table; slow permeability; fragipan.	Slow permeability; seasonal high water table; fragipan.	Seasonal high water table; erodes easily.	Forms large frozen clods; poor trafficability; high water table.	High corrosion potential; subject to caving; seasonal high water table.
Well drained ------	Moderate permeability; moderate available water capacity; large stones on UnB and UnD.	Moderate permeability; large stones on UnB and UnD.	Erodes easily; large stones on UnB and UnD; moderate available water capacity.	Forms large frozen clods in places; large stones on UnB and UnD; fair compaction.	Large stones on UnB and UnD; moderate corrosion potential.
Well drained ------	Rapid permeability; low and moderate available water capacity.	Rapid permeability; erodes easily.	Erodes easily; low and moderate available water capacity.	All features favorable.	Subject to caving.
Well drained ------	Moderately rapid permeability; very low available water capacity.	Rippable bedrock at a depth of 1 foot to 1½ feet; moderately rapid permeability.	Rippable bedrock at a depth of 1 foot to 1½ feet; very low water capacity.	All features favorable.	Rippable bedrock at a depth of 1 foot to 1½ feet.
Moderately slow permeability; seasonal high water table.	Seasonal high water table; moderately slow permeability; high available water capacity.	Moderately slow permeability; seasonal high water table; erodes easily.	Erodes easily; high available water capacity.	Forms large frozen clods; poor trafficability; seasonal high water table.	High corrosion potential; seasonal high water table.
Somewhat excessively drained.	Rapid permeability; very low and low available water capacity.	Rapid permeability; rarely floods.	Low available water capacity.	All features favorable.	Subject to caving.

properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrop or big stones, and freedom from flooding or a high water table.

Soil test data

Table 9 contains engineering test data for some of the major soil series in Centre County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at

TABLE 9.—*Engineering*

[Tests performed by the Pennsylvania Department of Transportation in accordance with standard procedures of the American

Soil name and location	Parent material	Pennsylvania report No.	Depth from surface	Moisture-density [1]		Fragments more than 3 inches in diameter	Mechanical analysis [2]			
				Maximum dry density	Optimum moisture		Percentage passing sieve—			
							2 in	1½ in	1 in	¾ in
			In	*Lb/cu ft*	*Pct*	*Pct*				
Clarksburg silt loam:										
3.0 miles west of Pine Grove Mills in Ferguson Township.	Colluvial material from limestone and nonacid shale.	BH–34035	19–26	102	22					
		BH–34036	38–54	109	17					
Dunning silty clay loam:										
1.5 miles east of Boalsburg in Harris Township.	Alluvial material washed from uplands underlain by limestone and acid and nonacid shale.	BK–36991	19–36	111	18					
		BK–36992	36–50	109	19					
Hagerstown silt loam:										
Between Pa–64 and cemetery at Zion in Walker Township.	Residual material from limestone.	BK–27597	31–43	102	23					100
		BK–27598	72–100	97	24					
Hublersburg silt loam:										
3.0 miles north of State College in Patton Township.	Residual material from impure limestone.	BK–36987	24–39	110	19					100
		BK–36988	91–114	99	22				100	98
Laidig channery loam:										
0.5 mile south of Pine Grove Mills in Ferguson Township.	Colluvial material from sandstone and siltstone.	71–20701	23–31	113	16	10		100	91	88
		71–20702	59–74	114	16	15		100	92	84
Leck Kill channery silt loam:										
4.0 miles west of Julian in Huston Township.	Residual material from shale, siltstone, and fine grained sandstone.	BM–18151	11–17	[7] 120	14	3		100	98	98
		BM–18152	26–36	125	11	5		100	98	96
Leetonia sand, variant:										
4.0 miles northwest of State College in Patton Township.	Residual material from sandstone.	BM–4518	12–21	114	11	6			100	99
		BM–4519	42–55	118	10	11		100	94	93
Millheim silt loam:										
On east side of L.R. 14043, 0.5 mile south of junction with Pa–45 in Gregg Township.	Residual material from shale.	BK–27591	17–26	96	27					
		BK–27592	34–42	92	29					
Murrill channery silt loam:										
3.0 miles northeast of Centre Hall in Gregg Township.	Colluvial material from acid sandstone over limestone residuum.	71–20699	22–34	112	16	5	100	88	83	83

test data

Association of State Highway and Transportation Officials (AASHTO). Absence of an entry indicates no determination was made]

Mechanical analysis—Continued									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued					Percentage smaller than—							
⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO [3]	Unified [4]
									Pct			
--------	100	98	93	83	76	65	51	[5] 44	42	10	A-5(8)	ML
100	99	97	92	80	72	55	38	33	35	15	A-6(10)	CL
--------	--------	100	99	95	94	78	61	50	44	21	A-7-6(13)	CL
--------	--------	--------	100	97	96	80	56	45	42	18	A-7-6(12)	CL
98	93	90	88	86	85	79	67	57	59	31	A-7-6(20)	CH
--------	--------	100	98	97	96	91	78	70	57	29	A-7-6(19)	CH
99	97	95	90	82	81	68	50	43	39	14	A-6(10)	CL
98	97	96	95	79	77	67	54	47	44	14	A-7-5(10)	ML
79	74	66	51	40	36	27	19	15	32	8	A-4(1)	SM
68	[5] 59	51	[5] 36	26	24	21	13	10	30	6	A-2-4(0)	GM
96	87	74	62	56	55	44	25	19	31	9	A-4(4)	CL
75	61	49	39	37	36	27	15	11	32	8	A-4(0)	GM
95	92	91	81	12	11	9	6	5	([6])	0	A-2-4(0)	SP-SM
93	93	92	81	13	12	12	10	9	([6])	0	A-2-4(0)	SM
--------	--------	100	99	98	97	87	67	54	52	20	A-7-5(14)	MH
--------	--------	100	99	97	84	61	49	38	55	22	A-7-5(16)	MH
80	79	77	69	51	48	40	30	25	31	10	A-4-(3)	CL

TABLE 9.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth from surface	Moisture-density [1]		Fragments more than 3 inches in diameter	Mechanical analysis [2]			
				Maximum dry density	Optimum moisture		Percentage passing sieve—			
							2 in	1½ in	1 in	¾ in
			In	*Lb/cu ft*	*Pct*	*Pct*				
Opequon silty clay loam: 3.0 miles southwest of Pine Grove Mills in Ferguson Township.	Residual material from limestone.	A–49599	9–14	111	18	5	--------	100	98	98

[1] Based on AASHTO Designation T 99, Method B (*2*).

[2] Mechanical analyses according to AASHTO Designation T 88 (*2*). Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture* content is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic; and the liquid limit, from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index in table 9 are based on tests of soil samples.

Formation and Classification of the Soils

In this section, the factors that have affected the formation and composition of the soils in Centre County are described, and some important morphological features are discussed. The system of soil classification is explained, and the classification of each soil series in the county is shown. Also in this section is a discussion of laboratory analyses of soils and how these analyses relate to classifying the soils.

Factors of Soil Formation

Soils are complex mixtures of weathered rock, minerals, organic matter, water, and air that occur in varying proportions. They formed through the chemical and physical weathering of geologic material. The extent of the weathering and the characteristics of any soil that forms depend on the nature of the parent material; the kind of climate; the relief, or lay of the land; the plant and animal life in and on the soil; and the length of time these factors have affected development.

In Centre County, where vegetation, time, and climate vary only slightly, the nature of the parent material produces more differences in the texture and mineral content of soils than most of the other soil-forming factors. Climate influences the nature and extent of the weathering processes. Relief affects drainage, aeration, runoff, erosion, and exposure to sun and wind. Plant and animal life influence soil characteristics by both physical and chemical removals and additions. Finally, time is required for the other soil-forming factors to exert their influence. Long periods of time are necessary for changes in soils to become apparent. Nevertheless, soils are slowly but constantly changing.

Parent material

The soils of Centre County formed mainly in material weathered from shale, siltstone, sandstone, and limestone. Limestone has weathered to form the parent material of the Hagerstown and Opequon soils. Acid siltstone and shale have weathered to form the parent material of the Weikert, Berks, and Leck Kill soils. Acid sandstone and conglomerate have weathered to form the parent material of the Hazleton, Clymer, and

test data—Continued

Mechanical analysis—Continued									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued					Percentage smaller than—							
⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO [3]	Unified [4]
									Pct			
94	92	89	86	79	76	64	45	34	41	17	A–7–6(11)	CL

[3] Based on AASHTO Designation M 145–49 (*2*).
[4] Based on the Unified soil classification system (*3*).
[5] The horizon of this sample contains slightly more clay than is typical in Clarksburg soils.
[6] In this sample, slightly less material passed this sieve than is common for soils of this series.
[7] This horizon has a slightly higher maximum dry density than is typical for this soil at this depth.
[8] Material too sandy to determine liquid limit.

Dekalb soils. Because their parent material was coarse-grained sandstone, Hazleton soils have a high content of sand. Ungers soils formed in material weathered from red shale and sandstone, which causes the red color of these soils.

Sediment deposited on terraces and flood plains of streams make up the parent material of the Allegheny, Philo, Atkins, Melvin, and Chagrin soils. The characteristics of these soils depend on the texture and other characteristics of the alluvial material.

Climate

Centre County has a humid-temperate, continental type of climate that is characteristic of the Middle Atlantic States. Some characteristics of the soils indicate that this kind of climate prevailed when the soils were forming and that it influenced soil formation. Many of the soils are acid and strongly leached.

The effect of climate on the formation of soils has been nearly uniform throughout the county. The formation of some soils, however, may have been influenced by a microclimate caused by differences in relief.

Relief

Relief largely depends on the nature of the underlying rock. The highest ridges in the landscape, such as those occupied by the Hazleton and Leetonia soils, occur where the rock is most resistant to weathering. Relief affects surface runoff. Runoff, in turn, affects the soils over which it flows. Water from runoff also enters streams that play a part in causing erosion and in dissecting areas of soil. Furthermore, in sloping or hilly areas, runoff and gravity cause soil material to wash or fall from the side slopes and to accumulate at the base of the slopes. Accumulated material at the base of slopes is an important part of the material in which the Laidig, Brinkerton, and Buchanan soils formed.

Plant and animal life

Hardwood trees have apparently had more effect on the formation of the soils of Centre County than other kinds of plants. Forests of hardwoods originally covered most of the county. The forests were mainly of the oak-hickory type, but forests of sugar maple, beech, and yellow birch occupied less extensive areas. Hemlock and pine occupied small areas at higher elevations. The sites where they grew were cooler and wetter than most sites at lower elevations.

The soils are typical of those that formed under forest. Where they have not been disturbed, a layer of leaf litter covers the surface and is underlain by a black O2 horizon 1 to 3 inches thick. The O2 horizon is commonly underlain by a dark colored A1 horizon 1 to 2 inches thick. Beneath the A1 horizon is a light colored A2 horizon several inches thick, similar to the A2 horizon in the profile described as representative of the Hazleton series.

When the forests were cleared and the soils were farmed, the layers of organic matter were incorporated into the plow layer or were burned. Thus, in many places the soils were left open to wind and rain that produced accelerated erosion.

Since the soils were first cleared, man has had a major effect on them through such practices as cultivation, liming, artificial drainage, manuring, and maintenance of perennial grasses and legumes. The neutral reaction of the upper 8 inches of the profile described as representative of the Hagerstown series is an example of man's influence.

Time

The length of time that the other factors of soil formation have operated is indicated, to some extent, by the degree of development of the soil profile. Some soils, especially those that formed in alluvium, show little profile development because the soil material has not been in place long enough for distinct horizons to form. Examples of soils that formed in alluvium are the Philo, Atkins, Melvin, and Chagrin soils. These soils show little horizon development because they are continually receiving deposits of fresh material on the surface. They are called young, or recent, soils.

The profile development of the Weikert, Berks, and Hazleton soils shows that some changes have taken place in the parent material. These changes, however, do not represent the effects of advanced weathering. Weathering and the development of the profile of those soils have been slowed by the effects of relief and by the kind of parent material.

Hagerstown, Laidig, Gilpin, and Morrison soils have well-developed profiles. In those soils the parent material has been in place long enough for distinct horizons to develop.

Processes of Horizon Differentiation

As weathering proceeds and plants grow on a young soil, several processes are apparent that tend to cause layers, or horizons, to develop in the soil. For example, soils gain material when leaves and plant remains accumulate on the surface. This accumulation is easily seen in areas of Dekalb, Hazleton, and other soils that formed under forest and have not been plowed. Additions of organic matter, chemicals, and mineral material are also brought in from adjacent areas by animals, floodwaters, and wind, or they are transferred as a result of gravity.

Losses from the soil occur when minerals decompose and, as a process in weathering, are leached from the soil. This process is apparent in the Hublersburg and Hagerstown soils, from which calcium carbonate has been leached. Losses also occur when plant nutrients are removed in harvested plants. In addition, fine particles of soil material are removed by erosion, and gases escape as organic matter decomposes.

The transfer or translocation of material from one part of the soil to another is common in most soils. Organic matter in suspension or solution is moved from the upper part of the profile to the lower part. Calcium is leached from the surface layer and is held by the clay in the subsoil. The Rayne and Laidig soils are examples of soils in which the results of this process can be seen. In those soils clay has accumulated in the B horizon as a result of transfer of clay from horizons higher in the profile.

Bases and plant nutrients are absorbed by the roots of plants and are moved upward in the stem to be stored in the leaves and twigs. When the plant dies and decays, the plant nutrients are returned to the soil.

Transformations occur as chemical weathering takes place. During weathering, iron, aluminum, calcium, and other elements are released from the primary and secondary minerals in the soil. For example, the gray and white colors of the parent material of a well-drained Hagerstown soil are gradually replaced by the red, brown, and yellow colors of oxidized iron compounds as the parent material weathers. These color changes indicate that iron has been released or that ferrous oxide has been oxidized to ferric oxide in the presence of an adequate supply of oxygen.

Major Soil Horizons

The results of the soil-forming processes are reflected in the different horizons developed in a soil profile. The soil profile extends from the surface downward to materials that are little altered by the soil-forming processes.

Most soils contain three major mineral horizons: A, B, and C. These major horizons may be further subdivided by the use of numbers and letters that indicate important characteristics of the subdivided horizons. An example is the B2t horizon, which designates a layer within the B horizon containing clay translocated from the A horizon. Most soils that have not been disturbed by cultivation have a thin organic horizon on top of the mineral soil. This organic horizon is designated by the letter O.

The A horizon is the surface mineral layer. That part of the A horizon having the largest accumulation of organic matter is called the A1 horizon. The A2 horizon is the layer of maximum leaching, or eluviation, of clay and iron. The A2 horizon of many soils in Centre County is brownish because of the oxidation of iron.

The B horizon lies underneath the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the A horizon. In some soils the B horizon forms through alteration of material in place rather than by illuviation. The alteration may be the result of oxidation and reduction of iron or the weathering of minerals. The B horizon generally has blocky or prismatic structure. It normally is firmer and lighter colored than the A1 horizon, but it is generally brighter colored than the C horizon.

Together, the A and B horizons constitute the solum —the zone in which most of the mineral and organic matter has been added, removed, transferred, or translocated through the soil-forming processes.

The C horizon is below the A and B horizons of most soils. It consists of materials that were little altered by the soil-forming processes, though the materials may be modified by weathering.

Below the C horizon in some soils is an R horizon of consolidated bedrock, such as limestone, shale, or sandstone. In a few soils the C horizon is lacking, and the R horizon is directly beneath the B horizon.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through

use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil Taxonomy" (*10*).

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable (*10*). The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 10, the soil series of Centre County are placed in four categories of the current system. Categories of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *soil* (Alf-i-sol).

SUBORDER: Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes that have the greatest

TABLE 10.—*Classification of the soils*

Series	Family	Subgroup	Order
Albrights	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Andover	Fine-loamy, mixed, mesic	Typic Fragiaquults	Ultisols.
Armagh	Clayey, mixed, mesic	Typic Ochraquults	Ultisols.
Atkins	Fine-loamy, mixed, acid, mesic	Typic Fluvaquents	Entisols.
Basher	Coarse-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Brinkerton	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols.
Buchanan	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols.
Calvin	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Carlisle	Euic, mesic	Typic Medisaprists	Histosols.
Cavode	Clayey, mixed, mesic	Aeric Ochraquults	Ultisols.
Chagrin	Fine-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Clarksburg	Fine-loamy, mixed, mesic	Typic Fragiudalfs	Alfisols.
Clymer	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Dekalb	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Dunning	Fine, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Edom	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Ernest	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Hagerstown	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Hazleton	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Hublersburg[1]	Clayey, illitic, mesic	Typic Hapludults	Ultisols.
Laidig	Fine-loamy, mixed, mesic	Typic Fragidults	Ultisols.
Leck Kill	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Leetonia	Sandy-skeletal, siliceous, mesic	Entic Haplorthods	Spodosols.
Leetonia variant	Sandy, siliceous, mesic	Entic Haplorthods	Spodosols.
Lindside	Fine-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Markes	Loamy-skeletal, mixed, mesic	Typic Ochraqualfs	Alfisols.
Meckesville	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Melvin	Fine-silty, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Millheim	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Monongahela	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Morrison	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Murrill	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Nolin	Fine-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Opequon	Clayey, mixed, mesic	Lithic Hapludalfs	Alfisols.
Philo	Coarse-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Pope	Coarse-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Purdy	Clayey, mixed, mesic	Typic Ochraquults	Ultisols.
Rayne	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Tyler	Fine-silty, mixed, mesic	Aeric Fragiaquults	Ultisols.
Ungers	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Vanderlip	Mesic, coated	Typic Quartzipsamments	Entisols.
Weikert	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Wharton	Clayey, mixed, mesic	Aquic Hapludults	Ultisols.
Wyoming	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.

[1] These soils have slightly higher base saturation than is defined as within the range for the series. In Centre County the Hublersburg series is classified as clayey, illitic, mesic Ultic Hapludalfs.

genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aqualf* (*Aqu,* meaning water or wet, and *alf,* from Alfisol).

GREAT GROUP: Soil suborders are divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have a pan that interferes with growth of roots, movement of water, or both; and those that have a thick, dark colored surface horizon. The features used are the self mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark red and dark brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Fragiaqualfs (*Fragi,* meaning having a fragipan horizon, *aqu* for wetness or water, and *alf,* from Alfisols). The great group is not shown separately in table 10, because it is the last word in the name of the subgroup.

SUBGROUP: Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Fragiaqualfs (a typical Fragiaqualf).

FAMILY: Soil families are distinguished within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae. An example is the fine-silty, mixed, mesic family of Typic Fragiaqualfs.

SERIES: The series consists of a group of soils that formed in a particular kind of parent material and that have genetic horizons that, except for the texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

Laboratory Soil Characterization [5]

Laboratory soil characterization identifies soil properties that are useful in studying soil forming processes, in interpreting land use potential and limitation, in classifying pedons and soil series, and in understanding genetic concepts of soils. The factors influencing soil formation can vary independently, soils can vary within seemingly uniform environments, and the study of soils in the field can have limitations; therefore, laboratory analyses are helpful in understanding soil relationships.

In this section, four soils, representing the range of parent materials in Centre County, were selected to illustrate characterization studies. These soils are Hagerstown silt loam, pedon 14–7, in the limestone valleys; Laidig very stony loam, pedon 14–31, in the side slope colluvium above the valleys; Leck Kill shaly silt loam, pedon 14–22, in red shale residuum; and Morrison fine sandy loam, pedon 14–10, in sand residuum on a ridge that extends through the county.

The characterization studies discussed in this section are based on detailed laboratory data by the Agronomy Department, The Pennsylvania State University (*4, 6*). These data are from Hagerstown, Laidig, Leck Kill, Morrison, and other soils and represent 15 of the 47 soil series in Centre County. These data are the result of physical, chemical, and mineralogical analyses and are particularly applicable to soils of the south-central part of Pennsylvania.

The following paragraphs are general interpretative discussions of some soil properties and factors that influence classification of the soils.

Clay content.—The amount of clay in a soil indicates its physical and chemical properties. Clay contributes to soil plasticity, shrink-swell potential, and cation exchange capacity. (See discussion of nutrients for explanation of cation exchange capacity.) Total water held in the soil increases as the clay content increases; however, water available to plants does not necessarily increase. Clay is a mobile component in soils and moves downward with percolating water. The extent of this translocation often reveals the state or degree of horizon development. For example, many soils contain a relatively low amount of clay in the surface layer, a higher amount between the depths of 25 to 75 centimeters (10 to 30 inches), and a decreased amount below a depth of 100 centimeters (40 inches). The clay-enriched zone is designated as an argillic horizon, a key feature in the study of soil formation. Translocation of clay is further discussed in the section "Processes of horizon differentiation."

Figure 17 illustrates the clay distribution in pedons representative of Laidig, Leck Kill, Hagerstown, and Morrison soils. The contrasting curves indicate that the four soils represent different amounts of clay movement. The depth of soil is closely approximate to the length of the curve, because samples were collected and analyzed from pits dug to bedrock or dug as deep as machine would allow. The development of the argillic horizons in Leck Kill, Morrison, and Hagerstown soils differ in degree. Laidig soils show little clay translocation, and clay content is close to the boundary between coarse-loamy and fine-loamy textural family classes. The clay distribution of Hagerstown soils is close to that expected for the Paleudult classification (soils that have low base status on old, stable land surface). Silt and sand data show that Leck Kill and Hagerstown soils contain mainly silt in the remaining fine earth (particles less than 2 millimeters in diameter);

[5] By Associate Professor R. L. CUNNINGHAM, Professor R. P. MATELSKI, Associate Professor E. J. CIOLKOSZ, Associate Professor G. W. PETERSEN, and Associate Professor R. PENNOCK, JR., Agronomy Department, The Pennsylvania State University.

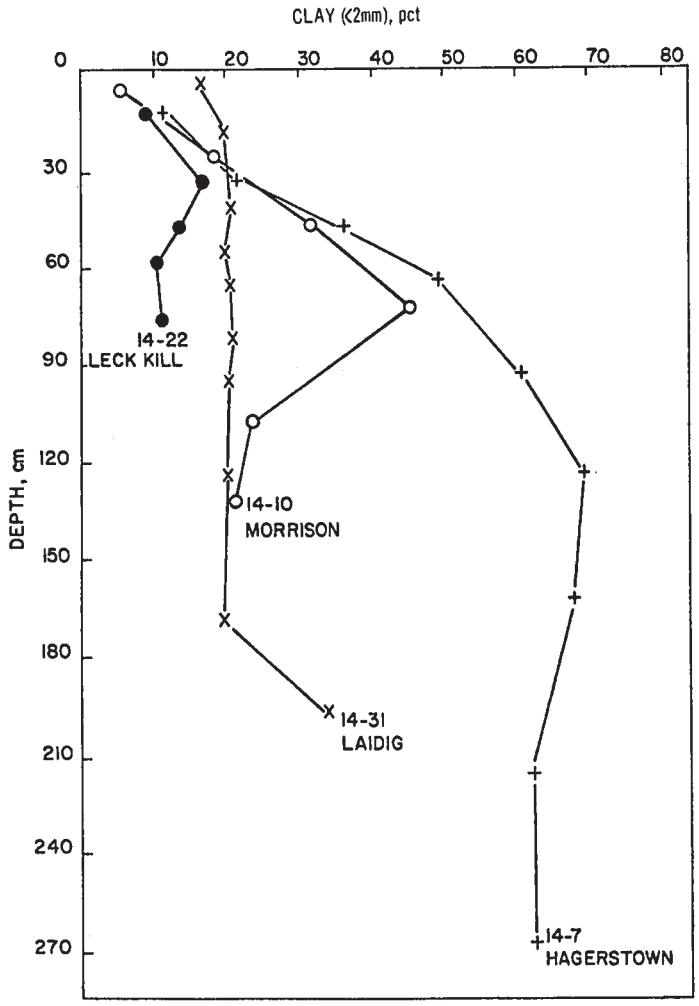

Figure 17.—**Clay distribution in representative profiles of four soil series.**

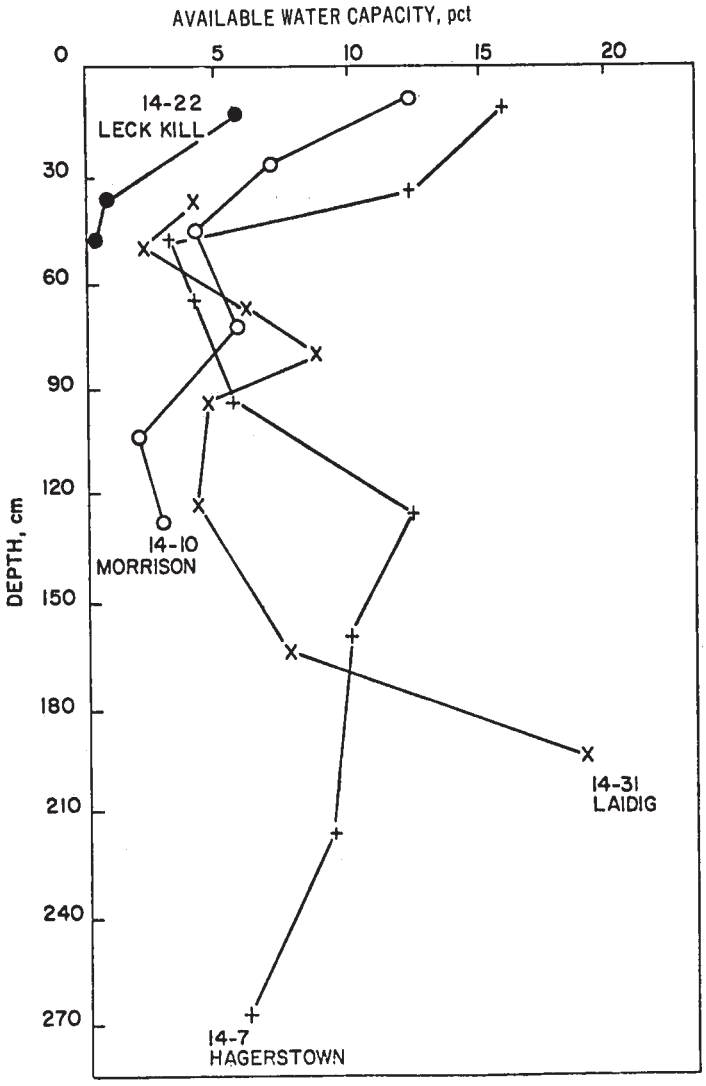

Figure 18.—**Available water capacity of four representative soil series.**

whereas Laidig and Morrison soils contain mainly sand.

Available water capacity.—The total water available to roots is partly dependent on soil depth. The deep Hagerstown soils (fig. 18) have the capacity to store more water than Leck Kill soils simply because Hagerstown soils are deeper. The curves show a trend toward less available water at a depth of about 50 centimeters (20 inches), where clay content tends to be highest and organic matter content is low. Coarse silt and very fine sand content of soils are positively correlated with available moisture capacity. The Leck Kill soil is droughty, because it contains only one-third as much water storage in the upper 30 centimeters (12 inches) as Hagerstown soils and, in addition, has greater coarse fragment content and less depth. Should Hagerstown soils become moistened to field capacity, plants rooting to a depth of 10 feet would have more than 10 inches of available water to extract.

Nutrients.—An indication of the nutrient holding capacity is the laboratory measured cation exchange capacity of the fine earth. The active mineral soil material, designated clay, is less than 0.002 millimeter in diameter, and trends in exchange capacity are generally shown by the trends in clay percentages. Organic matter content also contributes to cation exchange capacity, and the highest exchange capacity is in horizons that contain the most organic matter. The surface layer of the soils that were characterized have about 15 milliequivalents of exchange capacity per 100 grams of soil. Exchange capacity decreases in subsoil horizons, except where clay increases substantially.

Soils are acid or basic depending on the basic cation content of the exchange complex. When the cation exchange capacity of the clay and organic matter is dominated by hydrogen and aluminum ions, the soil is acid and pH is low. Conversely, the pH is high and the soil is neutral to alkaline when the complex is dominated by basic ions, mainly calcium. The humid climate in Centre County leads to precipitation and vegetation that deplete the soil of soluble calcium ions.

Figure 19 illustrates the changes in exchangeable calcium as depth increases for Laidig, Leck Kill, Hagerstown, and Morrison soils. The amount of exchangeable calcium indicates the soil chemistry of these soils. Hagerstown soils contain a moderate amount of exchangeable calcium, perhaps because of long term application of lime and because they formed in parent material high in calcium. Morrison and Laidig soils formed in material low in calcium and have essentially been depleted of all calcium. The Leck Kill soils have apparently had an application of lime to the surface in the recent past. The pH ranges from 4 to 5 for Morrison, Laidig, and Leck Kill soils and from 5 to 7 for Hagerstown soils. The soils that have low pH are also low in cations; Hagerstown soils, however, are moderate in magnesium, 2 to 5 milliequivalents per 100 grams in the subsoil. The extractable sodium cation is very mobile, and because of the humid climate in Centre County and the resulting leaching there is less than 0.1 milliequivalent of sodium per 100 grams of soil in all horizons analyzed. Potassium extracted is generally less than 0.2 milliequivalent but is as much as 0.7 milliequivalent per 100 grams in the subsoil of the Hagerstown soil.

Clay minerals.—Illite is the dominant clay material in the Hagerstown, Laidig, and Leck Kill soils, but weathering has produced some vermiculite in the surface layer. Kaolinite is the dominant clay mineral in the Morrison soils, and the other soils have only a small amount of kaolinite. Kaolinite clay is associated with the parent rock and is not the result of present weathering. Other soils, such as Hublersburg soils, can have a moderate to large amount of kaolinite where developed from the same geologic formation as the Morrison soil. An interstratified vermiculite-illite complex is in surface horizons of all four soils. Chlorite was present in only trace amounts.

Coarse fragments.—Particles that are more than 2 millimeters in diameter are not included in chemical, mineralogical, and some physical analyses, and they are called coarse fragments. Figure 20 shows the weight percentages of fragments in the total soil material at different depths.

Soils that have a high percentage of fragments are less desirable for most uses. A high proportion of fragments, such as more than 60 percent in Laidig soils below a depth of 100 centimeters, dilute the effectiveness of the fine earth part of the soil (particles less than 2 millimeters in diameter). For example, if a horizon is 50 percent fragments and the fine earth is

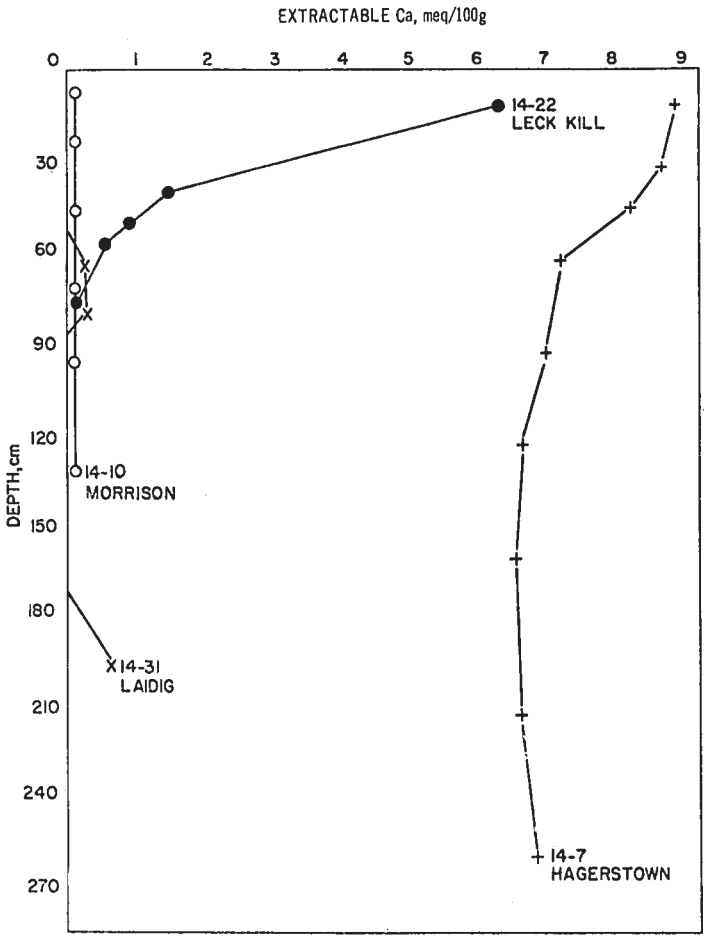

Figure 19.—Extractable calcium of four representative soil series.

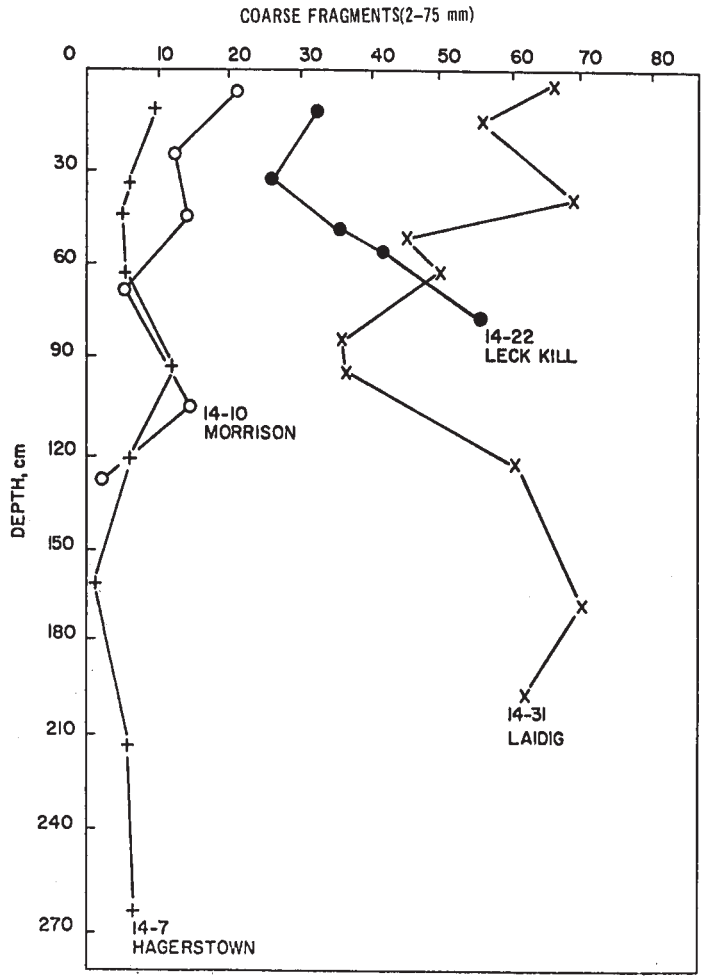

Figure 20.—Coarse fragments of four representative soil series.

20 percent clay, then the clay percentage for the total soil horizon is 10 percent. Analogous calculations can be made for other physical and all chemical properties of the fine earth.

Surface fragments dissipate some of the energy of raindrops. Therefore, soils with a moderate amount of coarse fragments on the surface tend to resist erosion. Percolation of water through soil is often more rapid where the percentage of coarse fragments is greatest, if other properties are similar.

The few fragments in Hagerstown soils are chert and are generally less than 2 inches in diameter. Morrison soils often contain much more sandstone than indicated by the curve in figure 19. Shale increases as depth increases in Leck Kill soils to the point where it is difficult to determine the difference between parent material and bedrock. The colluvial nature of Laidig soil is evident from the high content of shale and sandstone fragments most of which are more than 2 inches in diameter.

Percolation rates.—Percolation testing by Bureau of Public Health standards are available for the 28 sites characterized in Centre County. The four soils under discussion are well drained and have rates of more than 2.5 centimeters per hour (1 inch per hour). However, Leck Kill soils generally have a limiting factor of depth to bedrock, Hagerstown soils have a possible contamination of ground water through caves and sinkholes, and Laidig soils have a fragipan, coarse fragments, and steep slopes that often limit their use as septic tank effluent drainage fields. Also, Laidig soils have a percolation rate of less than 2.5 centimeters per hour in most places.

General Nature of the County

This section gives some general information about Centre County. It describes physiography, geology, and drainage and provides information about water supply and climate.

Physiography, Geology, and Drainage [6]

Centre County is located in the Appalachian Plateaus and the Valley and Ridge physiographic provinces. The provinces are separated by the Allegheny Front, which is just north of the northeast-southwest trending Bald Eagle Valley. The Appalachian Plateaus in the northwestern third of the county, are subdivided into the Allegheny High Plateau, Pittsburgh Plateau, and Allegheny Mountain sections. The Appalachian Mountain section, in the eastern and southern parts of the county, is part of the Valley and Ridge province. Each province has distinct and different topographic and geologic features that have influenced soil formation and accepted land use in Centre County.

The bedrock geology of the Appalachian Plateaus is represented by Devonian, Mississippian, and Pennsylvanian rocks consisting primarily of sandstone, shale, limestone, and conglomerate formations. In the northern part of the county, coal is present in the Allegheny and Pottsville Group of Pennsylvanian age.

[6] Prepared by BRUCE A. BENTON, geologist, Soil Conservation Service.

The formation of the Appalachian Plateaus began after Paleozoic marine and nonmarine deposition. During the late Paleozoic Era regional uplift from the southeast caused this area to rise uniformly, without much disturbance, to bedrock altitudes. The topography of today is a result of dissection of this plateau by streams that gave the areas the appearance of rolling hills. Several unnamed hills reach elevations of about 2,500 feet in the southeast corner of the county.

The bedrock geology of the Valley and Ridge province is represented by Cambrian, Ordovician, Silurian, and Devonian rocks consisting primarily of dolomite, limestone, sandstone, quartzite, conglomerate, and shale formations.

The Paleozoic beds of the Valley and Ridge province underwent lateral compression from the southeast that formed many deeply folded anticlinal and synclinal features. The final stage of erosion followed the last period of compressional uplift. Different bedrock lithology and exposure in this complex network of folds has resulted in the development of broad and narrow valleys and ridges. The ridges formed because the sandstone and quartzite formations capping the ridges resist erosion while the valleys formed in less resistant limestone and dolomite. Many of the valleys are karst limestone valleys where caverns, sinkholes, and poorly defined drainage are prominent. Both valleys and ridges in the county are oriented northeast-southwest. Some of the high ridges in the county are Mount Nittany (2,345 feet) and Tussey Mountain (2,407 feet).

In order of decreasing value, the mineral resources in Centre County are lime, stone, coal, sand and gravel, and clay (*11*). Centre County is the leading producer of lime (quicklime and hydrated lime) in the state. Stone production ranks high and represents about 5 percent of the total value of Pennsylvania's stone production. Bituminous coal mining ranks less than 1 percent of the total bituminous coal mining in the state.

Centre County lies in the Susquehanna River basin. About three-quarters of the county lies in the West Branch of the Susquehanna River drainage area. The major tributaries contributing to the West Branch are the northeast-flowing Moshannon and Beech Creeks. The remaining part of the county is drained by Spruce Creek, which is in the southwest corner of the county and is a tributary of the Juniata River, and Penns Creek, which is in the southeast corner and flows east into the Susquehanna River.

Water Supply

Centre County is in the Susquehanna River basin. Moshannon Creek, Black Moshannon Creek, Beech Creek, Bald Eagle Creek, Little Fishing Creek, and Penns Creek are the major streams in the county. Each of these streams has many potential impoundment sites that could be developed for municipal and industrial water supply, recreation, and flood control purposes. Many of the streams in the northwestern part of the county have been polluted by acid drainage. Sayers Reservoir on Bald Eagle Creek was constructed by the U.S. Army Corps of Engineers for flood control and recreation. Several smaller dams have been con-

structed in the past for recreation or water supply but do not have flood control capabilities.

Potential subsurface water supplies vary, depending on the nature of the underlying rock. Where sandstone bedrock is dominant, quantity and quality of water are generally good. Where shale is the dominant underlying rock, quantities are generally limited, and quality of water is variable. On the Allegheny Plateau in the northwestern part of the county, the subsurface water from many of the shale areas has excess minerals that may make it unpalatable and objectionable to use if not treated. In the eastern Penns Valley area, much of the well water from the carbonaceous shales has a high sulfur content and the associated offensive odors.

Where springs or surface seep areas are available, their development for water supplies can be an economical method of overcoming the problems of unsatisfactory well water in shale areas. In the valley areas underlain by limestone, quantity of water is generally quite good if the well is located in a rock fissure, but quality may be questionable. In the limestone areas the ground water travels through large solution channels and rock fissures, making water sources difficult to locate. Ground water in this area is also easily contaminated by sewage or industrial wastes that are dumped into dry wells or sinkholes.

Climate [7]

The climate of Center County is a composite of relatively dry midwestern continental climate and the more humid climate characteristic of the eastern seaboard. Prevailing westerly winds carry weather disturbances from the interior of the country into the area. Coastal storms occasionally affect the day-to-day weather as they move northeastward, but generally the Atlantic Ocean has only a limited influence on the climate of Centre County. The climatic details discussed in the following paragraphs are based on data from State College unless stated otherwise.

Winters are cold and relatively dry. Widespread cloudiness in winter causes the daily temperature range to be smaller than in any other season. Minimum temperatures remain below freezing much of the time from mid-November through most of March, but seldom drop below zero. The lowest temperature ever recorded at State College was −20° F on February 10, 1899. Occasional short periods of unusually warm temperatures for the season are recorded. Winter precipitation falls as rain, snow, or sleet; however, most of it falls in the form of snow. The annual average snowfall for more than two-thirds of the winters has ranged from 30 to 60 inches. The extremes have ranged from 17.6 inches in the winter of 1918–19 to 91.9 inches in the winter of 1960–61. Snowstorms seldom last longer than 1 to 2 days; however, in late March 1942 a 3-day storm produced 31 inches of snow. Snow covers the ground to varying depths during much of the winter.

Summer and fall are the most pleasant seasons of the year. During summer 60 percent of possible sunshine is received. In summer maximum temperatures generally reach the low 80's, although nighttime minimum temperatures drop to near 60° because of cold air drainage from the nearby mountains. During short warm periods, daily maximum temperatures can rise above 90°. The extreme maximum temperature recorded at State College is 102° on July 9, 1936. Precipitation is normally abundant and evenly distributed throughout the year. Precipitation of 0.10 inch or more occurs on an average of 7 days per month. Summer rainfall is generally the result of showers and thunderstorms. These are heavy at times but are of short duration. Rains of 0.5 to 1.0 inch in less than an hour are common. Extended dry periods are rare.

The period of greatest precipitation on record occurred from June 20 to 29, 1972. During this time span, a total of 12.68 inches of rainfall was recorded at Mid-State Airport. The storm of June 20 to 26, known as Hurricane Agnes, accounted for 11.47 inches of the total. A peak rainfall of 6.73 inches in 24 hours occurred on June 22, 1972.

Spring and fall are the transition seasons when temperatures cover a broad range. Maximum temperatures average close to 50° in early April and rise to the mid-70's by the end of May. Nights remain cold into May. The average date of the last spring freeze is April 27, and the average date of the first fall freeze is October 14. This provides an average growing season of 170 days. Growing seasons range from 116 to 198 days. Freezing temperatures have been reported as late as May 24 in spring and as early as September 11 in fall. Abundant sunshine in autumn provides warm afternoons through mid-October in most years.

Temperatures for the higher areas of Centre County can vary a few degrees from the foregoing discussion depending on elevation. Some of the higher areas tend to have cooler high temperatures because of elevation and warmer low temperatures because of nighttime cold air drainage to lower elevations. At these locations, the growing season is longer than at the lowest elevations. At the highest elevations, however, a colder temperature regime, both maximum and minimum, exists and consequently these highest elevations have the shortest growing season in the county. The higher elevations normally receive more precipitation than at State College.

Climatological data for the county is summarized in tables 11 and 12.

[7] Prepared by National Climatic Center, Asheville, N.C.

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TABLE 11.—*Temperature and precipitation*

[Data from State College, Pennsylvania; period of record 1941–70]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total precipitation	One year in 10 will have—		Days with snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	34.2	19.8	50	2	2.34	1.17	4.01	15	5
February	36.1	20.2	52	4	2.09	.69	3.40	14	5
March	45.4	27.7	65	13	3.43	1.69	4.77	9	4
April	59.2	38.9	78	26	3.34	1.62	5.25	1	2
May	70.2	48.8	85	36	4.03	1.64	7.22	----------	----------
June	78.7	57.3	90	46	3.34	1.80	5.70	----------	----------
July	82.6	61.1	91	52	3.54	1.58	4.81	----------	----------
August	80.7	59.1	90	48	3.41	1.52	5.69	----------	----------
September	73.5	52.0	87	37	2.59	1.22	4.15	----------	----------
October	62.9	42.5	78	30	2.77	1.06	4.61	----------	----------
November	48.7	33.2	64	21	3.28	1.60	5.28	2	3
December	36.3	22.9	53	7	2.61	.87	4.55	10	4
Year	59.0	40.3	[1] 94	[2] −2	36.77	30.35	43.54	51	4

[1] Average annual maximum

[2] Average annual minimum.

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data are from State College, Centre County, Pennsylvania; period of record, 1941–70]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 30	April 8	April 13	April 25	May 12.
2 years in 10 later than	March 24	April 2	April 8	April 20	May 7.
5 years in 10 later than	March 12	March 21	March 28	April 10	April 27.
Fall:					
1 year in 10 earlier than	November 21	November 7	October 31	October 11	September 27.
2 years in 10 earlier than	November 26	November 13	November 4	October 17	October 3.
5 years in 10 earlier than	December 5	November 23	November 13	October 29	October 14.

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Glossary

Acidity. See Reaction, soil.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well areated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial soil. Soil formed in recently deposited stream material and showing little or no modification of the original material.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	More than 5.2

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bearing strength. This is the load supporting capacity of a soil. This strength can vary for a specific soil, depending on the amount of compaction and the moisture content.

Bedding, land. Plowing, grading, or otherwise elevating the surface of fields into a series of parallel beds, or lands, that have shallow surface drains separating them.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock, depth.
(a) Shallow to bedrock. Less than 20 inches to solid bedrock.
(b) Moderately deep to bedrock. 20 to 40 inches to solid rock.
(c) Deep to bedrock. 40 inches or more to solid bedrock.

Bedrock, hardness.
(a) Rippable. Usually presents few excavation problems with modern equipment.
(b) Hard. Usually requires specialized techniques such as drilling and blasting for excavation.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Conglomerate. Rock composed of gravel and rounded stones cemented together.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular production, or a crop grown between trees and vines in orchards and vineyards.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artifi-

cially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow, of water from an area.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Flaggy soil. A soil that contains relatively thin, flat fragments of sandstone, limestone, or shale that are 6 to 15 inches long. A single piece is a flagstone.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterways. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

High water table. A zone of saturation in the soil, within 6 inches of the surface during a considerable part of the year. It may be caused by a normal ground water table or a perched water table. The presence of a high water table is indicated by mottling within 6 inches of the surface. A high water table is associated with poorly drained and very poorly drained soils.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Karst. An area underlain by limestone that has dissolved to form numerous depressions or small basins, causing irregular relief.

Leaching. The removal of soluble material from soil or other material by percolating water.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		pH
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Residual soil. Soil formed from material weathered from the underlying consolidated rock.

Rock outcrops or ledges. Solid bedrock exposed at the surface.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seasonal high water table. A zone of saturation in the soil that is within 6 to 36 inches of the surface during at least part of the year. A seasonal high water table is usually caused by a fluctuating water table generally not associated with the ground water table. It is indicated by mottling within 6 to 36 inches of the surface. It is associated with somewhat poorly drained and moderately well drained soils.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in the landscape where limestone has been locally dissolved away.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or a sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water holding capacity. See available water capacity.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

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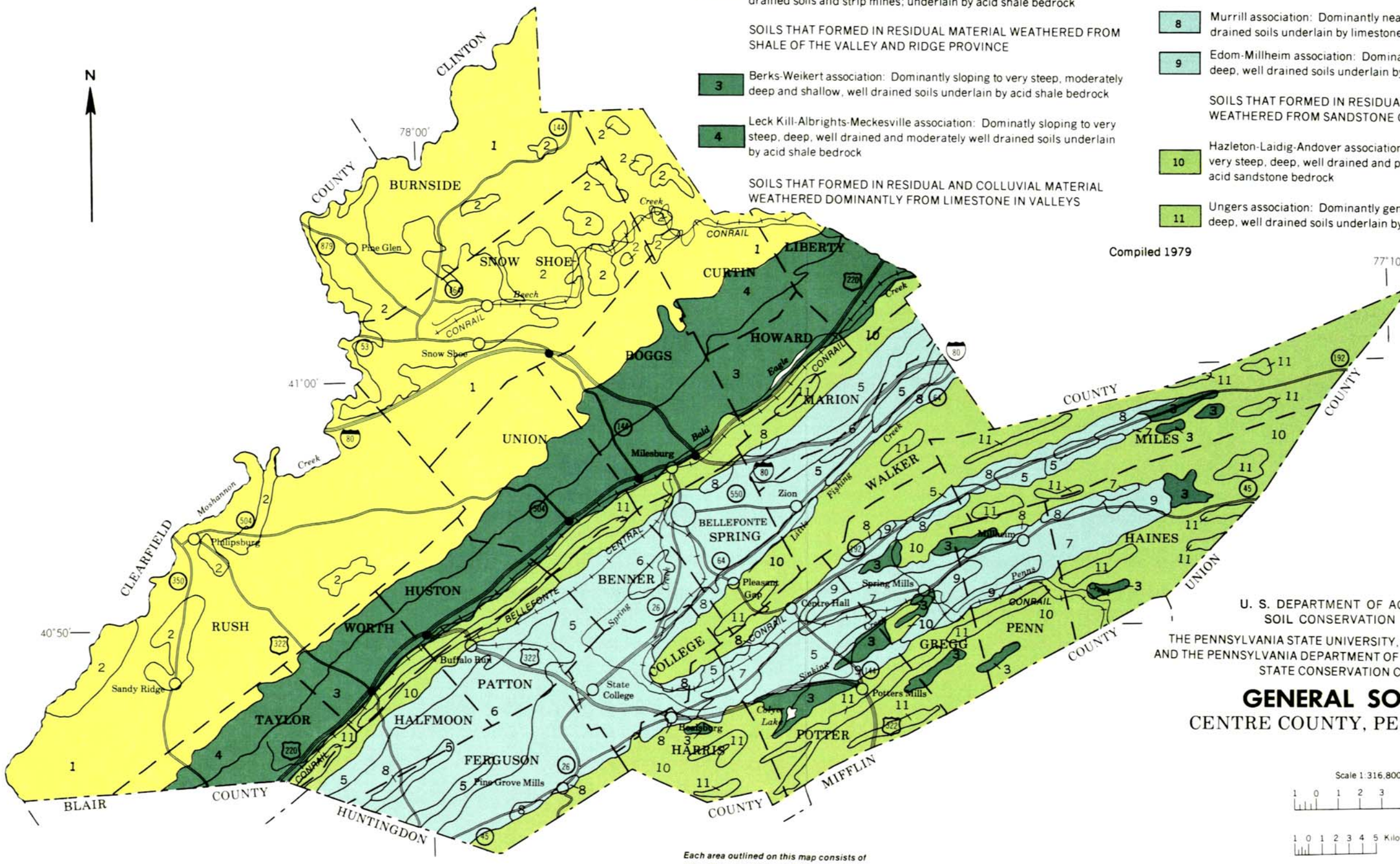


LEGEND

SOILS THAT FORMED IN RESIDUAL MATERIAL WEATHERED FROM SANDSTONE AND SHALE ON THE ALLEGHENY PLATEAU

1 — Hazleton-Clymer association: Dominantly gently sloping to very steep, deep, well drained soils underlain by acid sandstone bedrock

2 — Wharton-Gilpin-Strip Mines association: Dominantly gently sloping and sloping, deep and moderately deep, moderately well drained and well drained soils and strip mines; underlain by acid shale bedrock

SOILS THAT FORMED IN RESIDUAL MATERIAL WEATHERED FROM SHALE OF THE VALLEY AND RIDGE PROVINCE

3 — Berks-Weikert association: Dominantly sloping to very steep, moderately deep and shallow, well drained soils underlain by acid shale bedrock

4 — Leck Kill-Albrights-Meckesville association: Dominatly sloping to very steep, deep, well drained and moderately well drained soils underlain by acid shale bedrock

SOILS THAT FORMED IN RESIDUAL AND COLLUVIAL MATERIAL WEATHERED DOMINANTLY FROM LIMESTONE IN VALLEYS

5 — Hagerstown-Opequon-Hublersburg association: Dominantly nearly level to sloping, deep and shallow, well drained soils underlain by limestone bedrock

6 — Morrison association: Dominantly gently sloping to moderately steep, deep, well drained soils underlain by limy sandstone

7 — Opequon-Hagerstown association: Dominantly gently sloping and sloping, shallow and deep, well drained soils underlain by limestone bedrock

8 — Murrill association: Dominantly nearly level to sloping, deep, well drained soils underlain by limestone bedrock

9 — Edom-Millheim association: Dominantly gently sloping and sloping, deep, well drained soils underlain by nonacid shale bedrock

SOILS THAT FORMED IN RESIDUAL AND COLLUVIAL MATERIAL WEATHERED FROM SANDSTONE ON RIDGES

10 — Hazleton-Laidig-Andover association: Dominantly gently sloping to very steep, deep, well drained and poorly drained soils underlain by acid sandstone bedrock

11 — Ungers association: Dominantly gently sloping to moderately steep, deep, well drained soils underlain by acid sandstone bedrock

Compiled 1979

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES STATE CONSERVATION COMMISSION

GENERAL SOIL MAP

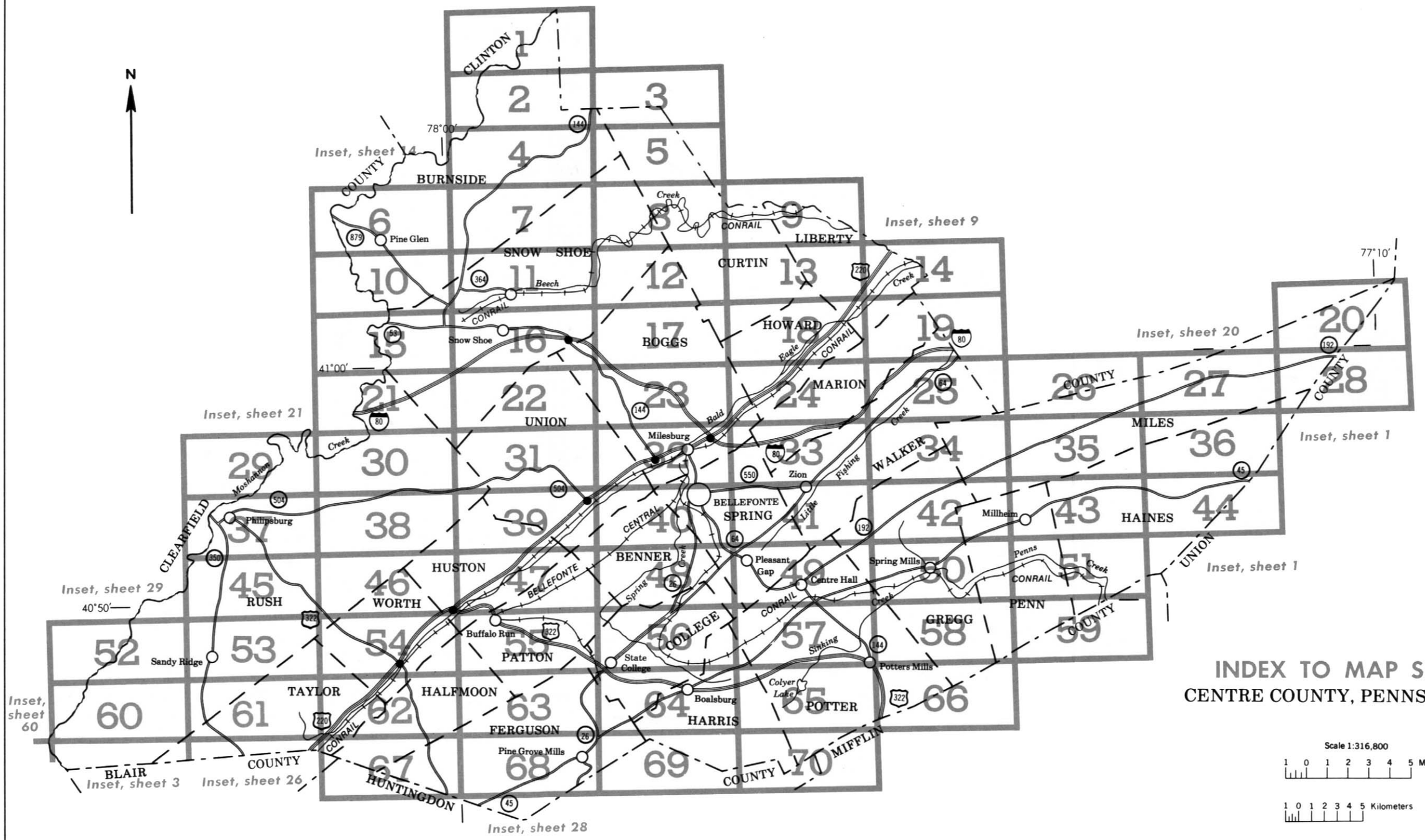
CENTRE COUNTY, PENNSYLVANIA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 1 2 3 4 5 Kilometers

1-13506



INDEX TO MAP SHEETS

CENTRE COUNTY, PENNSYLVANIA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 1 2 3 4 5 Kilometers

Compiled 1979

1-13506

SOIL LEGEND

The first letter, always a capital is the initial letter of the soil name. The second is usually a small letter but it is a capital letter if the unit is broadly defined. The third letter, A, B, C, D, or F shows the slope class. Most symbols without a slope letter are for nearly level soils, but some are for miscellaneous land types.

SYMBOL	NAME
AbB	Albrights silt loam, 3 to 8 percent slopes
AbC	Albrights silt loam, 8 to 15 percent slopes
AcB	Albrights very stony silt loam, 0 to 8 percent slopes
AcC	Albrights very stony silt loam, 8 to 15 percent slopes
AlB	Allegheny silt loam, 2 to 8 percent slopes
AnB	Andover channery loam, 0 to 8 percent slopes
AnC	Andover channery loam, 8 to 15 percent slopes
AoB	Andover very stony loam, 0 to 8 percent slopes
AoC	Andover very stony loam, 8 to 15 percent slopes
ArA	Armagh silt loam, 0 to 3 percent slopes
ArB	Armagh silt loam, 3 to 8 percent slopes
At	Atkins silt loam
Ba	Basher loam
BkB	Berks shaly silt loam, 3 to 8 percent slopes
BkC	Berks shaly silt loam, 8 to 15 percent slopes
BkD	Berks shaly silt loam, 15 to 25 percent slopes
BlD	Berks very stony silt loam, 8 to 25 percent slopes
BMF*	Berks and Weikert soils, steep
BrA	Brinkerton silt loam, 0 to 3 percent slopes
BrB	Brinkerton silt loam, 3 to 8 percent slopes
BrC	Brinkerton silt loam, 8 to 15 percent slopes
BsB	Brinkerton very stony silt loam, 0 to 8 percent slopes
BtB	Buchanan loam, 2 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
BuC	Buchanan channery loam, 8 to 15 percent slopes
BxB	Buchanan extremely stony loam, 0 to 8 percent slopes
BxD	Buchanan extremely stony loam, 8 to 25 percent slopes
CA*	Carlisle muck
CdA	Cavode silt loam, 0 to 3 percent slopes
CdB	Cavode silt loam, 3 to 8 percent slopes
Ch	Chagrin soils
CkA	Clarksburg silt loam, 0 to 3 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
ClB	Clymer sandy loam, 3 to 8 percent slopes
ClC	Clymer sandy loam, 8 to 15 percent slopes
CvB	Clymer very stony sandy loam, 0 to 8 percent slopes
CvD	Clymer very stony sandy loam, 8 to 25 percent slopes
Du	Dunning silty clay loam
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
ErB	Ernest channery silt loam, 3 to 8 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
ErD	Ernest channery silt loam, 15 to 25 percent slopes
EvB	Ernest very stony silt loam, 3 to 8 percent slopes
EvD	Ernest very stony silt loam, 8 to 25 percent slopes
GlB	Gilpin channery silt loam, 2 to 8 percent slopes
GlC	Gilpin channery silt loam, 8 to 15 percent slopes
GlD	Gilpin channery silt loam, 15 to 25 percent slopes
HaA	Hagerstown silt loam, 0 to 3 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HaC	Hagerstown silt loam, 8 to 15 percent slopes
HcB	Hagerstown silty clay loam, 3 to 8 percent slopes
HcC	Hagerstown silty clay loam, 8 to 15 percent slopes
HcD	Hagerstown silty clay loam, 15 to 25 percent slopes
HhB	Hazelton channery sandy loam, 3 to 8 percent slopes
HhC	Hazelton channery sandy loam, 8 to 15 percent slopes
HhD	Hazelton channery sandy loam, 15 to 25 percent slopes
HSB*	Hazelton extremely stony sandy loam, gently sloping
HSD*	Hazelton extremely stony sandy loam, moderately steep
HTF*	Hazelton-Dekalb association, very steep
HuA	Hublersburg silt loam, 0 to 3 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
HuC	Hublersburg silt loam, 8 to 15 percent slopes
HuD	Hublersburg silt loam, 15 to 25 percent slopes
LaB	Laidig channery loam, 3 to 8 percent slopes
LaC	Laidig channery loam, 8 to 15 percent slopes
LaD	Laidig channery loam, 15 to 25 percent slopes
LcB	Laidig extremely stony loam, 0 to 8 percent slopes
LcD	Laidig extremely stony loam, 8 to 25 percent slopes
LDF*	Laidig extremely stony loam, steep
LkB	Leck Kill channery silt loam, 3 to 8 percent slopes
LkC	Leck Kill channery silt loam, 8 to 15 percent slopes
LkD	Leck Kill channery silt loam, 15 to 25 percent slopes
LlB	Leck Kill very stony silt loam, 0 to 8 percent slopes
LlD	Leck Kill very stony silt loam, 8 to 25 percent slopes
LMF*	Leck Kill and Calvin soils, steep
LtB	Leetonia extremely stony loamy sand, 0 to 12 percent slopes
LvB	Leetonia sand, variant, 3 to 8 percent slopes
LvC	Leetonia sand, variant, 8 to 15 percent slopes
Lx	Lindside soils
MaB	Markes silt loam, 2 to 10 percent slopes
MeB	Meckesville silt loam, 3 to 8 percent slopes
MeC	Meckesville silt loam, 8 to 15 percent slopes
MkB	Meckesville very stony silt loam, 0 to 8 percent slopes
MkD	Meckesville very stony silt loam, 8 to 25 percent slopes
Mm	Melvin silt loam
MnB	Millheim silt loam, 2 to 8 percent slopes
MnC	Millheim silt loam, 8 to 15 percent slopes
MnD	Millheim silt loam, 15 to 25 percent slopes
MoB	Monongahela silt loam, 2 to 8 percent slopes
MrB	Morrison sandy loam, 2 to 8 percent slopes
MrC	Morrison sandy loam, 8 to 15 percent slopes
MrD	Morrison sandy loam, 15 to 25 percent slopes
MsB	Morrison very stony sandy loam, 0 to 8 percent slopes
MsD	Morrison very stony sandy loam, 8 to 25 percent slopes
MTF*	Morrison very stony sandy loam, steep
MuA	Murrill channery silt loam, 0 to 3 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
MuC	Murrill channery silt loam, 8 to 15 percent slopes
MuD	Murrill channery silt loam, 15 to 25 percent slopes
MvB	Murrill very stony silt loam, 0 to 8 percent slopes
MvD	Murrill very stony silt loam, 8 to 25 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
ORF*	Opequon-Hagerstown complex, steep
OxB	Opequon-Rock outcrop complex, 0 to 8 percent slopes
OxD	Opequon-Rock outcrop complex, 8 to 25 percent slopes
Ph	Philo loam
Pk	Philo and Atkins very stony soils
Po	Pope soils
Pu	Purdy silt loam
RaB	Rayne silt loam, 2 to 10 percent slopes
Ru	Rubble land
Sm	Strip mines, acid
Ty	Tyler silt loam
UmB	Ungers channery loam, 3 to 8 percent slopes
UmC	Ungers channery loam, 8 to 15 percent slopes
UmD	Ungers channery loam, 15 to 25 percent slopes
UnB	Ungers very stony loam, 0 to 8 percent slopes
UnD	Ungers very stony loam, 8 to 25 percent slopes
URB*	Urban land-Hagerstown complex, gently sloping
VaC	Vanderlip loamy sand, 5 to 20 percent slopes
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
WeD	Weikert shaly silt loam, 15 to 25 percent slopes
WhA	Wharton silt loam, 0 to 3 percent slopes
WhB	Wharton silt loam, 3 to 8 percent slopes
WhC	Wharton silt loam, 8 to 15 percent slopes
WyA	Wyoming gravelly sandy loam, rarely flooded, 0 to 5 percent slopes

* The composition of these units is more variable than that of other units in the survey area but has been controlled well enough to interpret for the expected uses of the soils.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; W)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; W)
- Intermittent (Int; I)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)
- Cherty spot (#)

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 1

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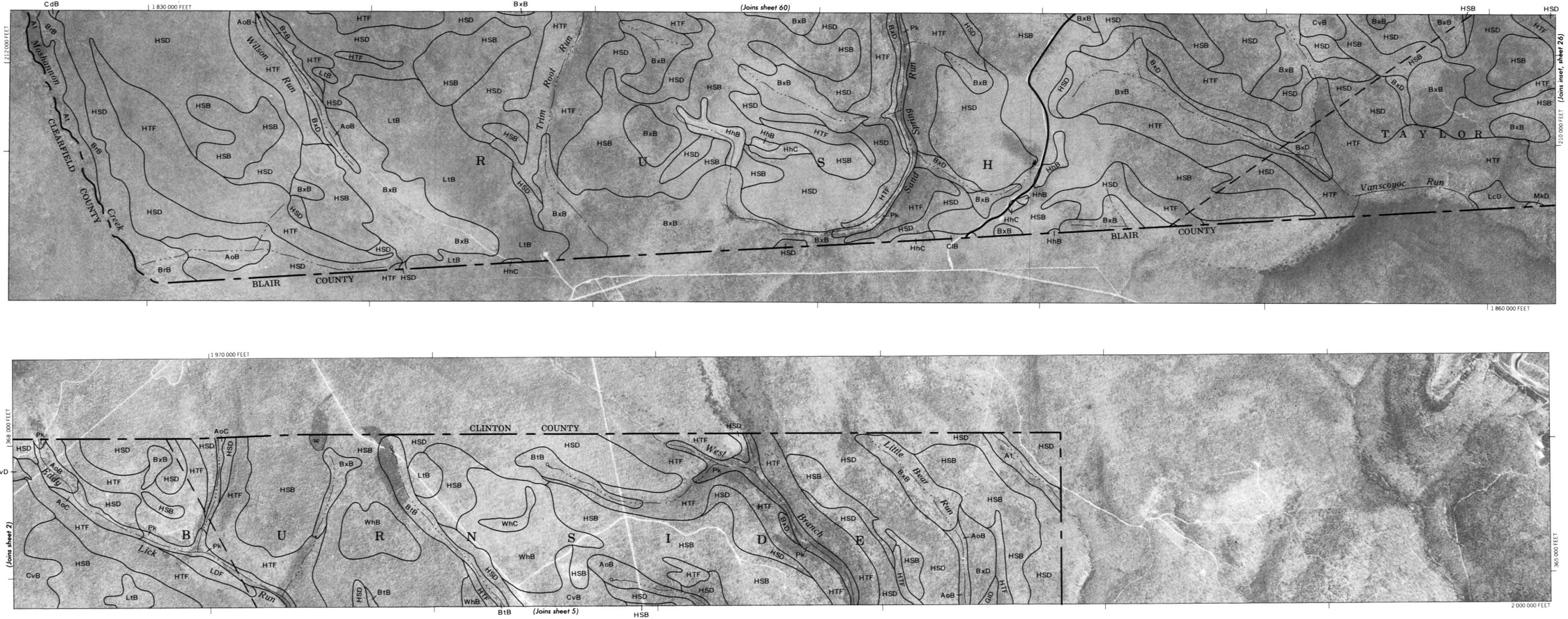

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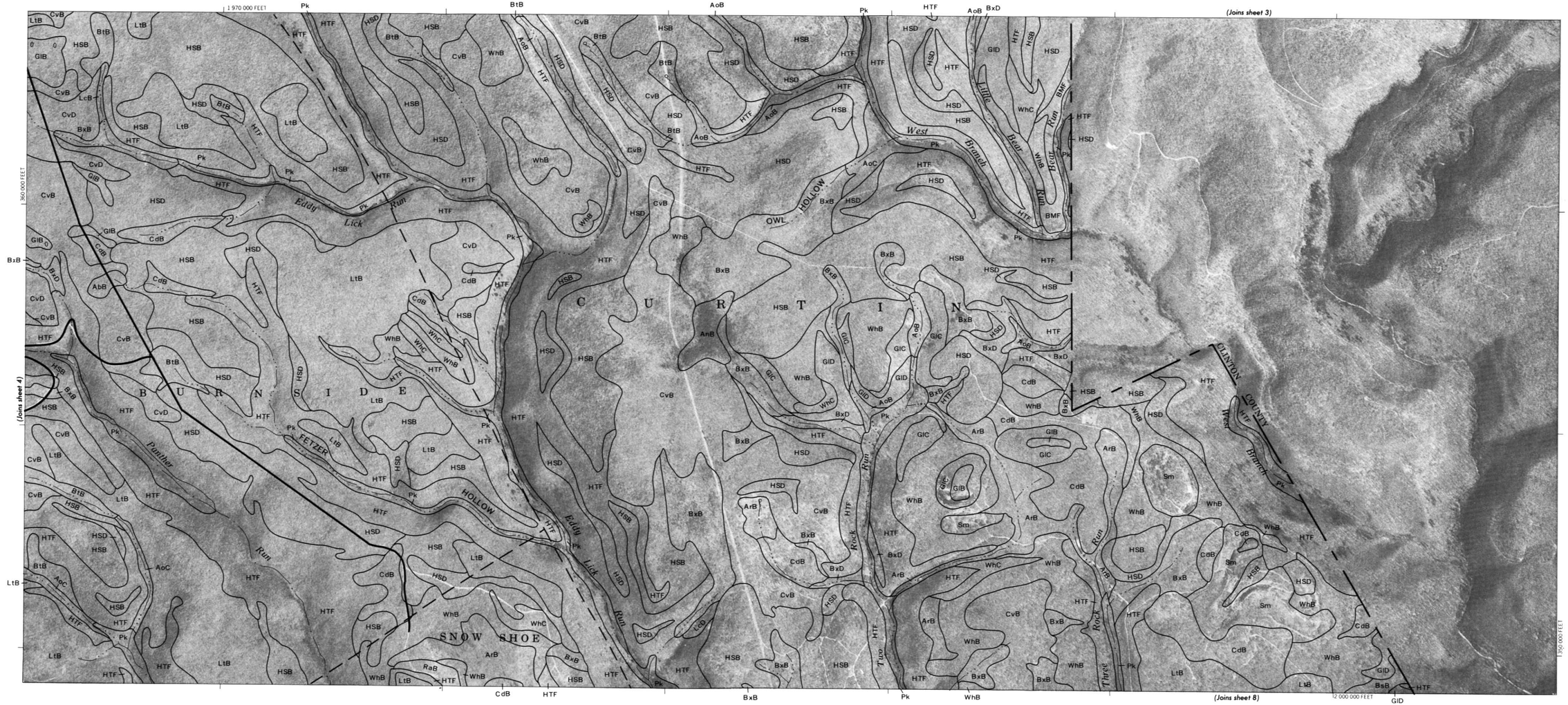

5

N

1 Mile
5 000 Feet

Scale 1:20000

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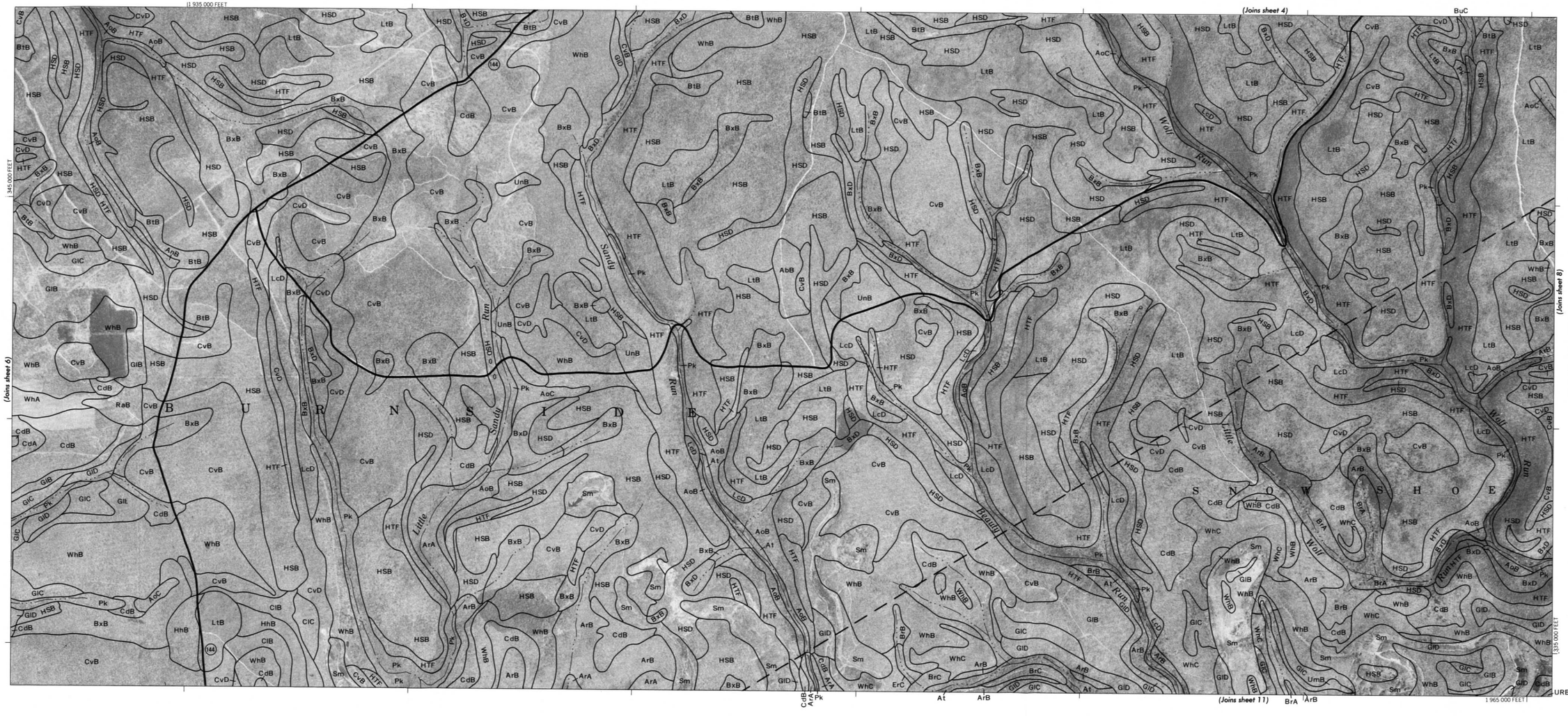

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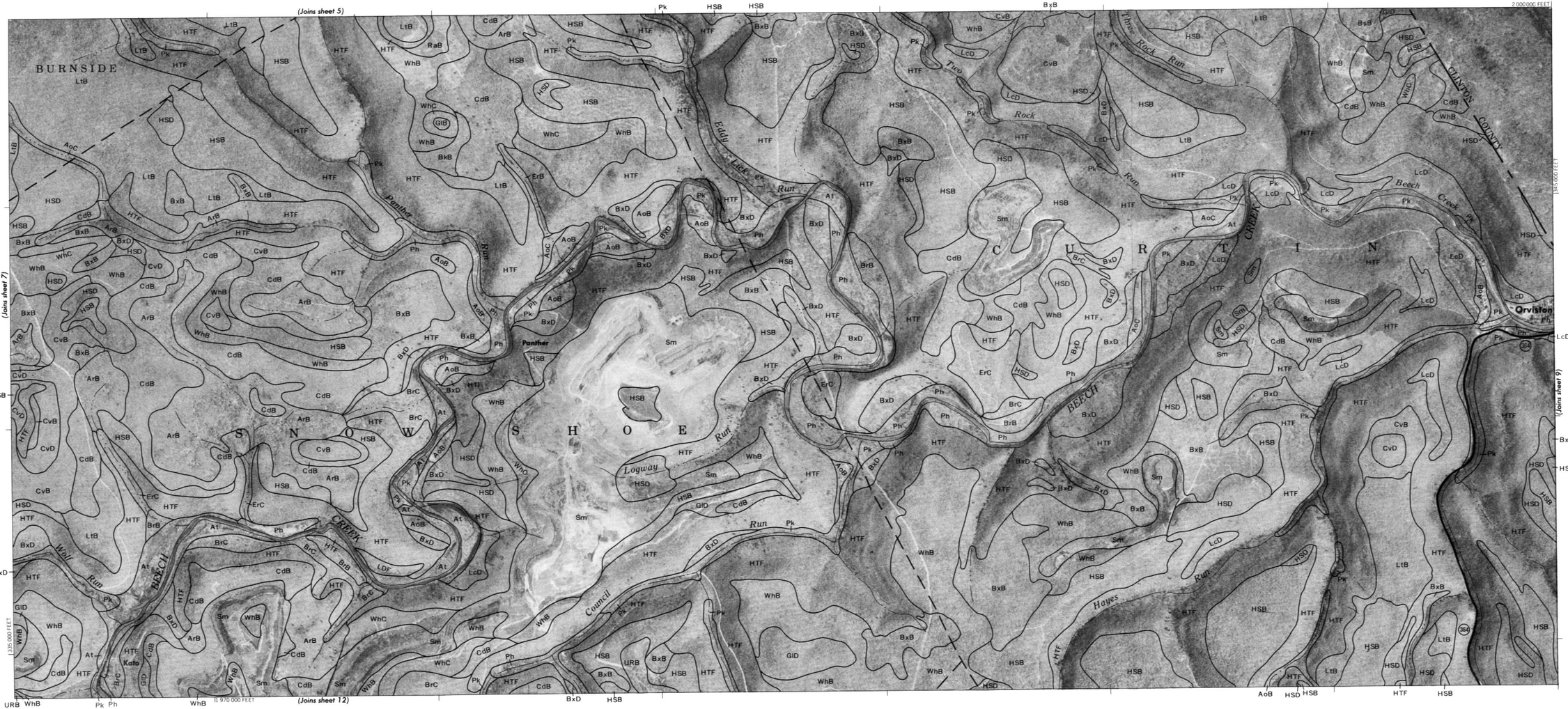

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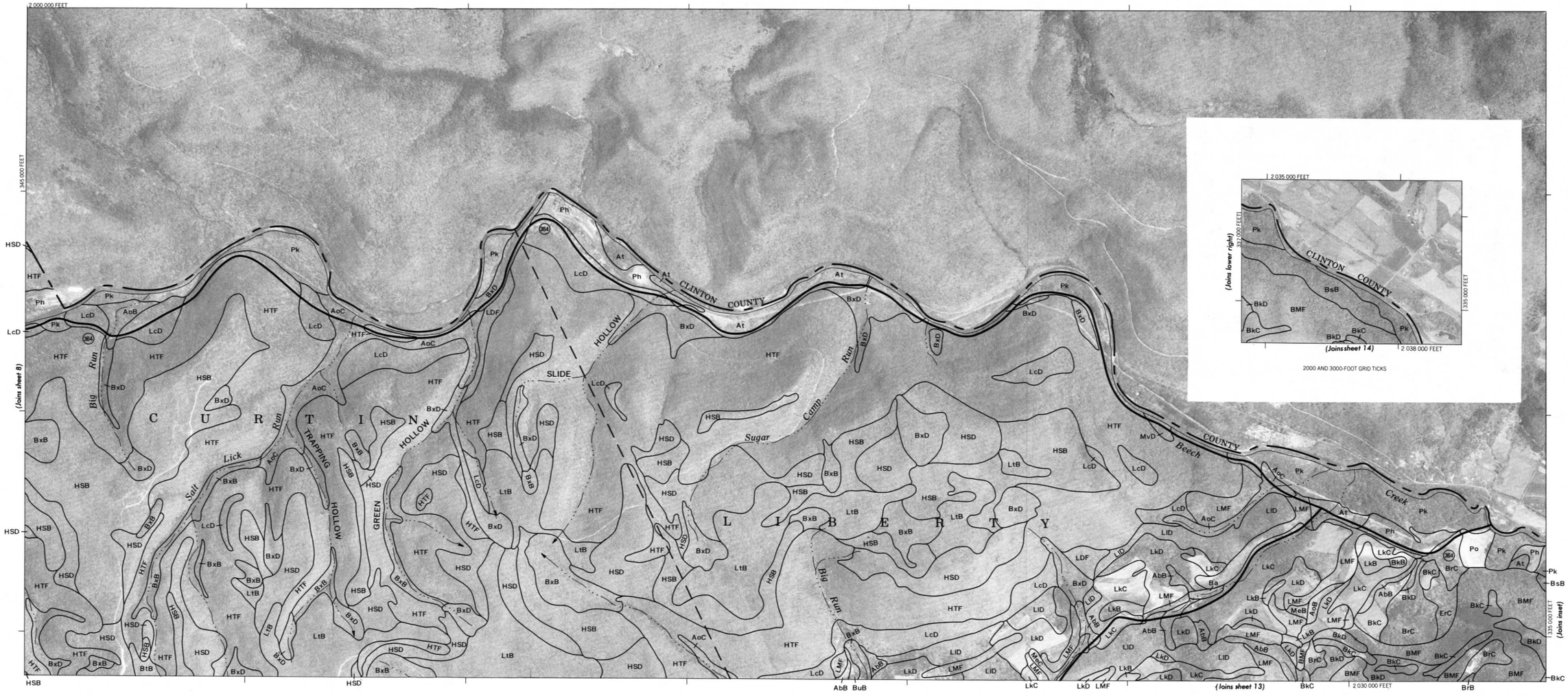
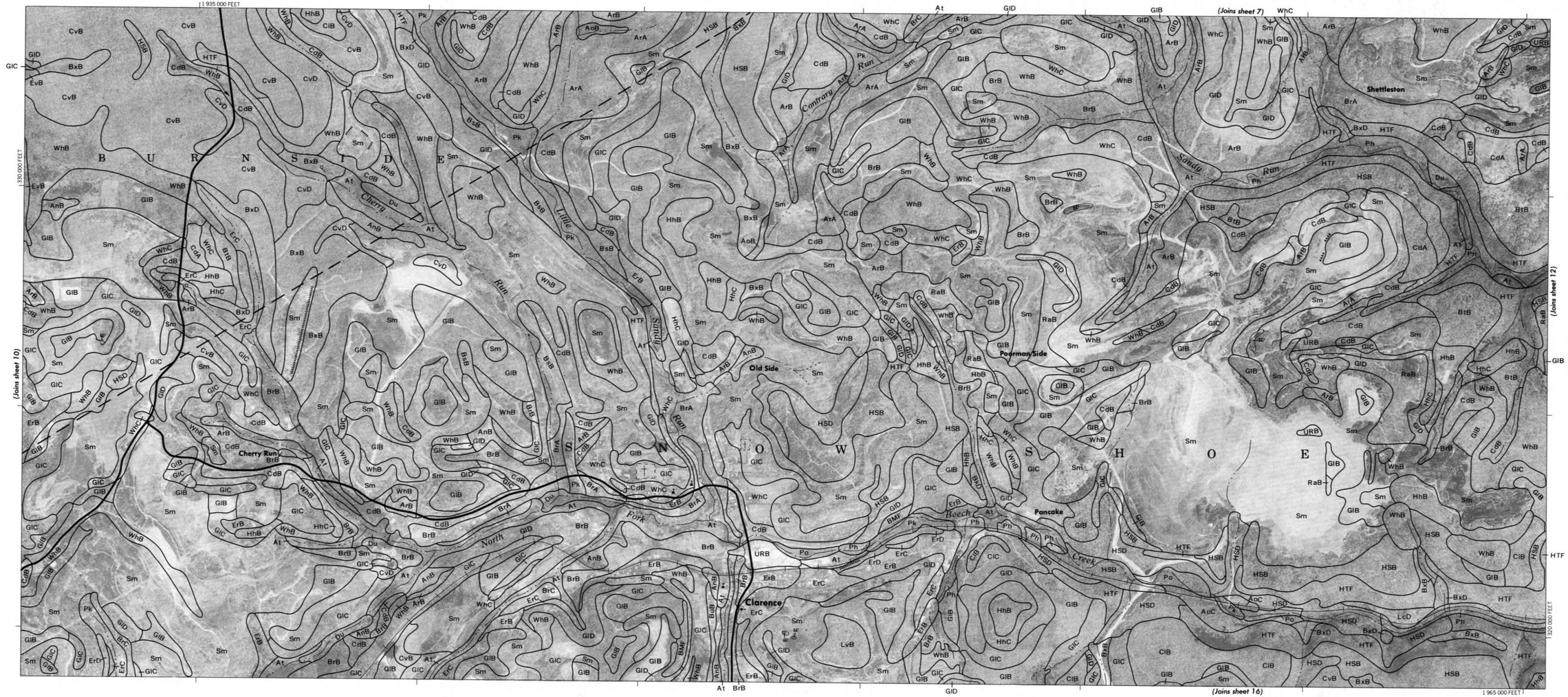


CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 10

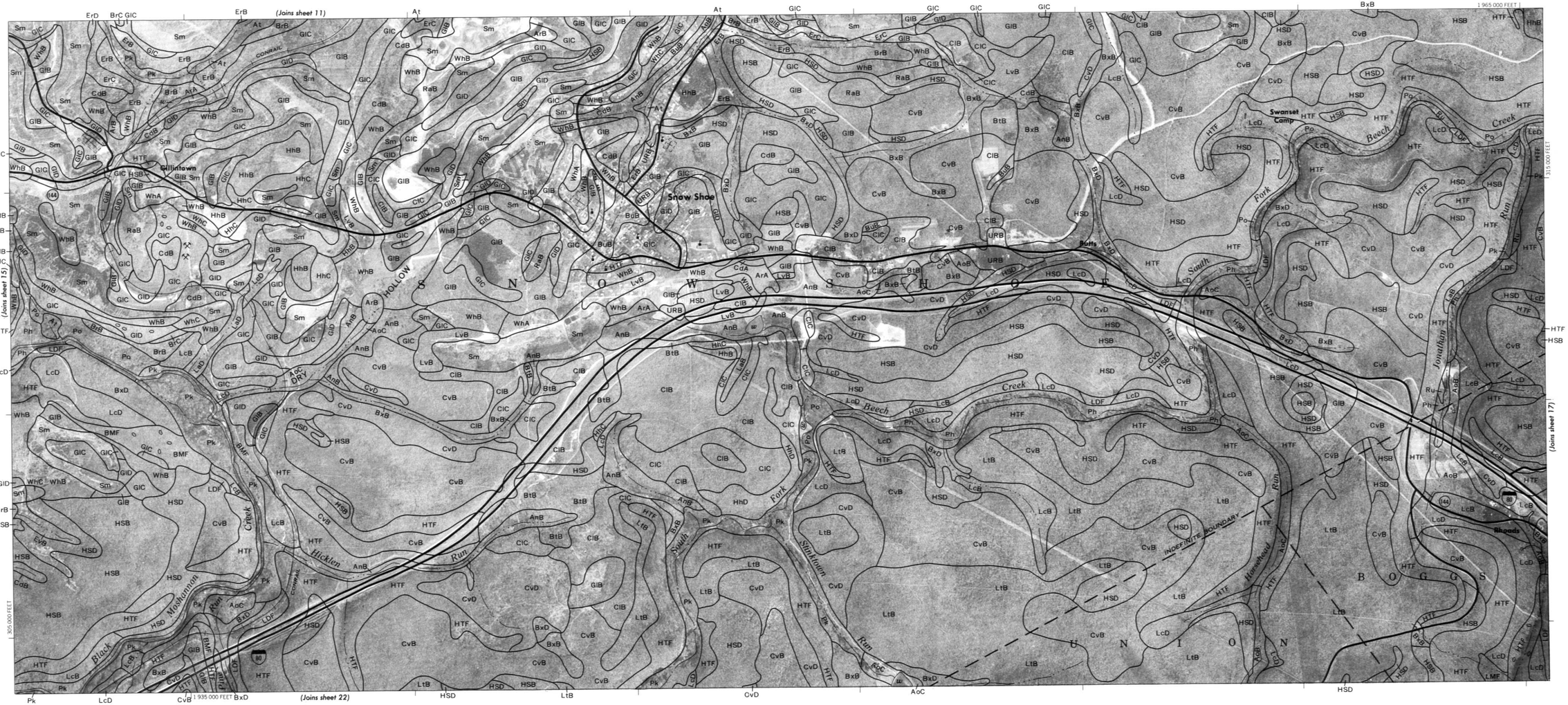
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and grid division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 11

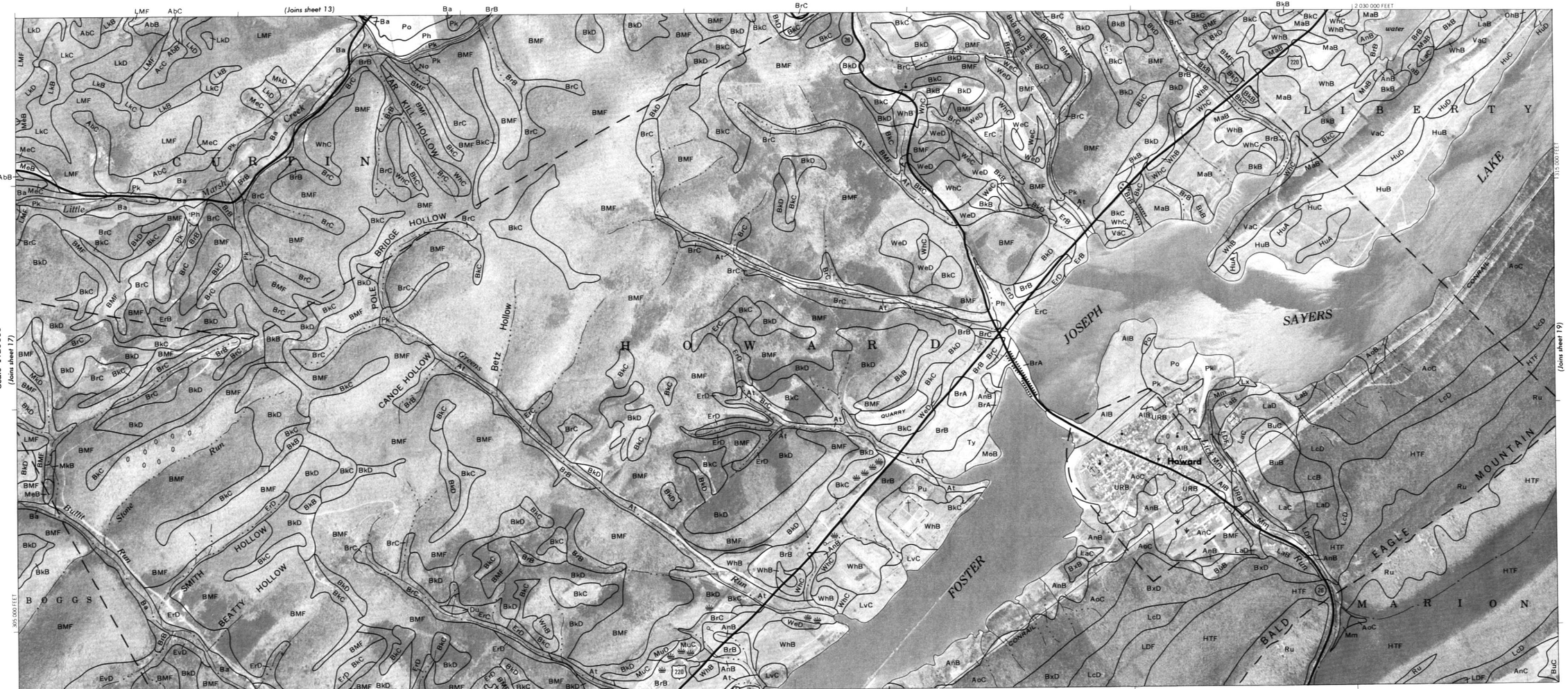


This map is compiled on 1972 U.S. Geological Survey Orthophotographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

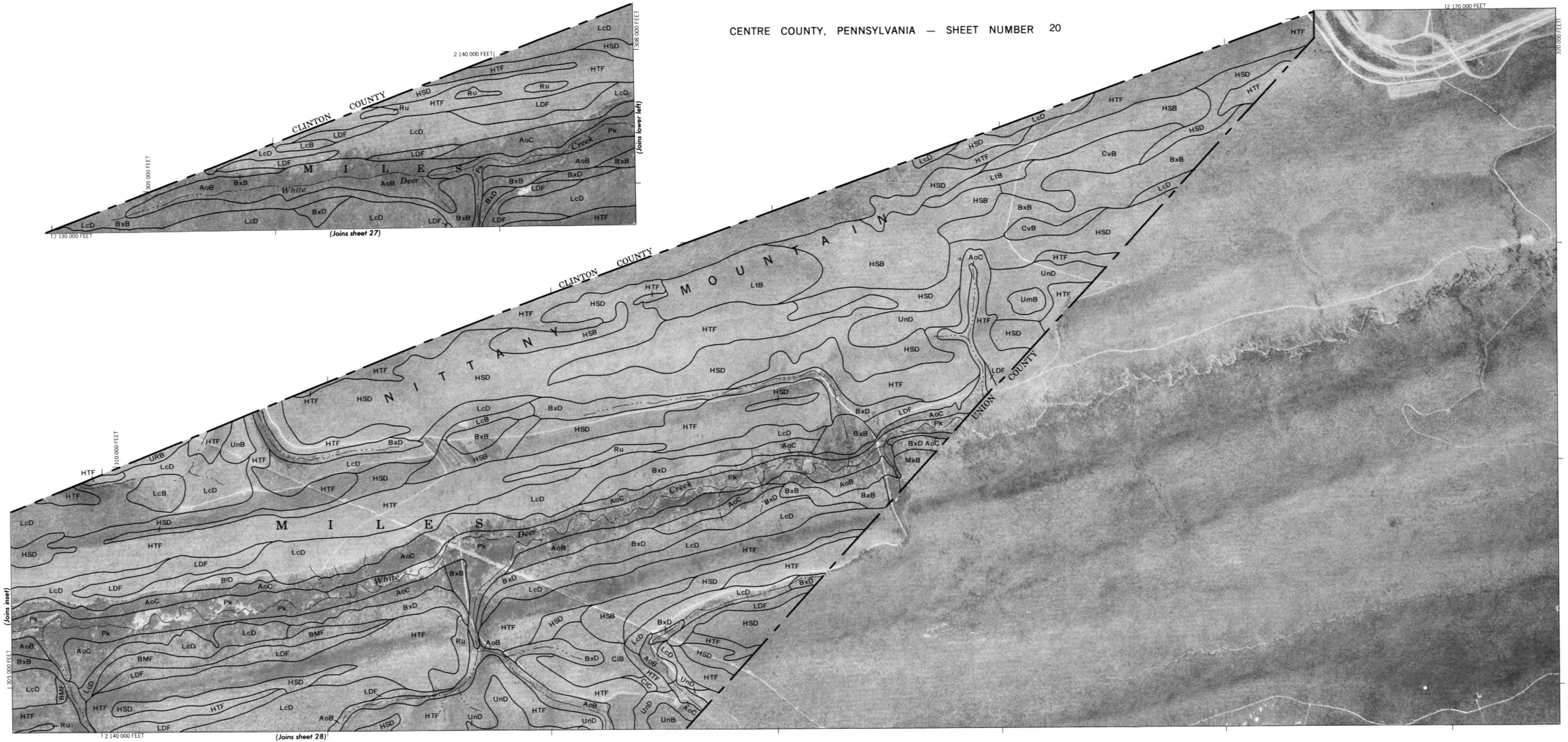
This map is compiled on 1977 U.S. Geological Survey Orthophotographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned



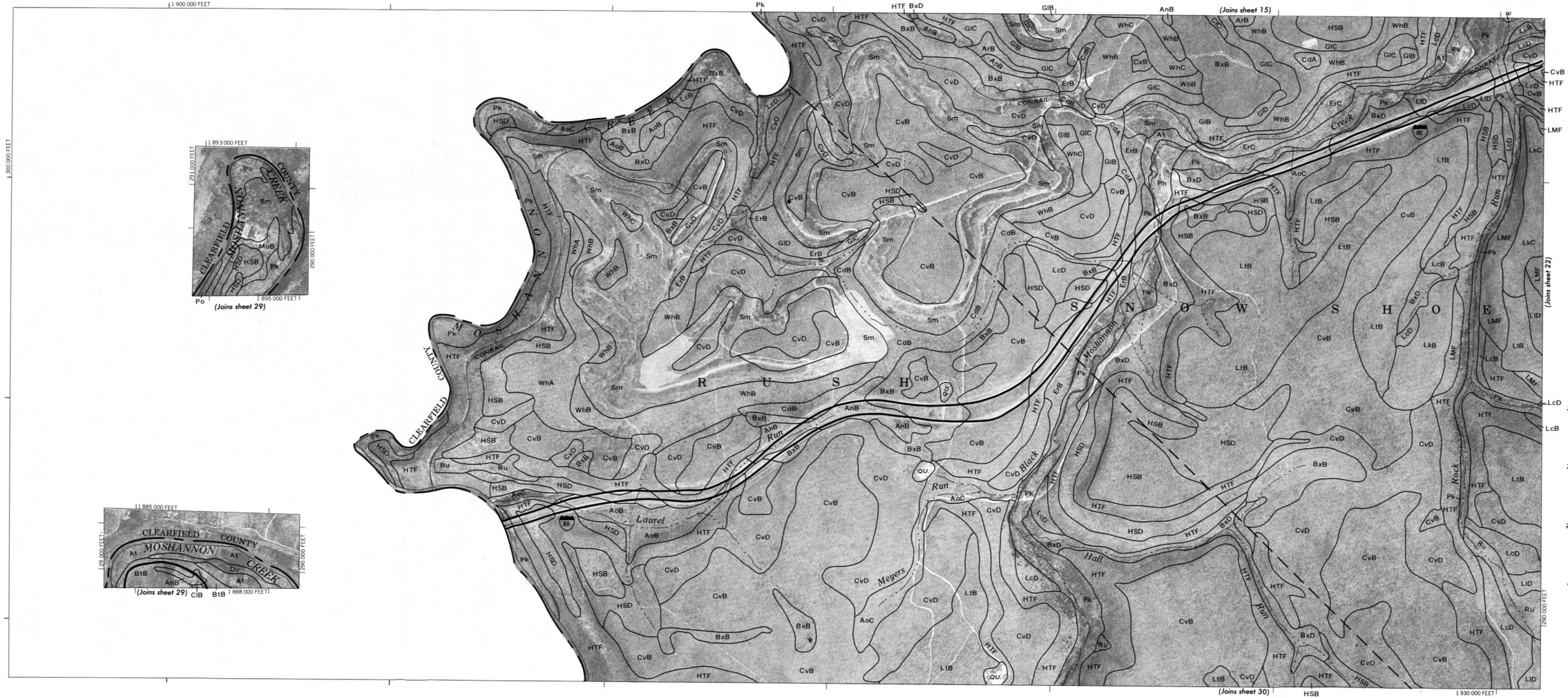
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks used blind (corners, if shown, are approximately positioned).



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



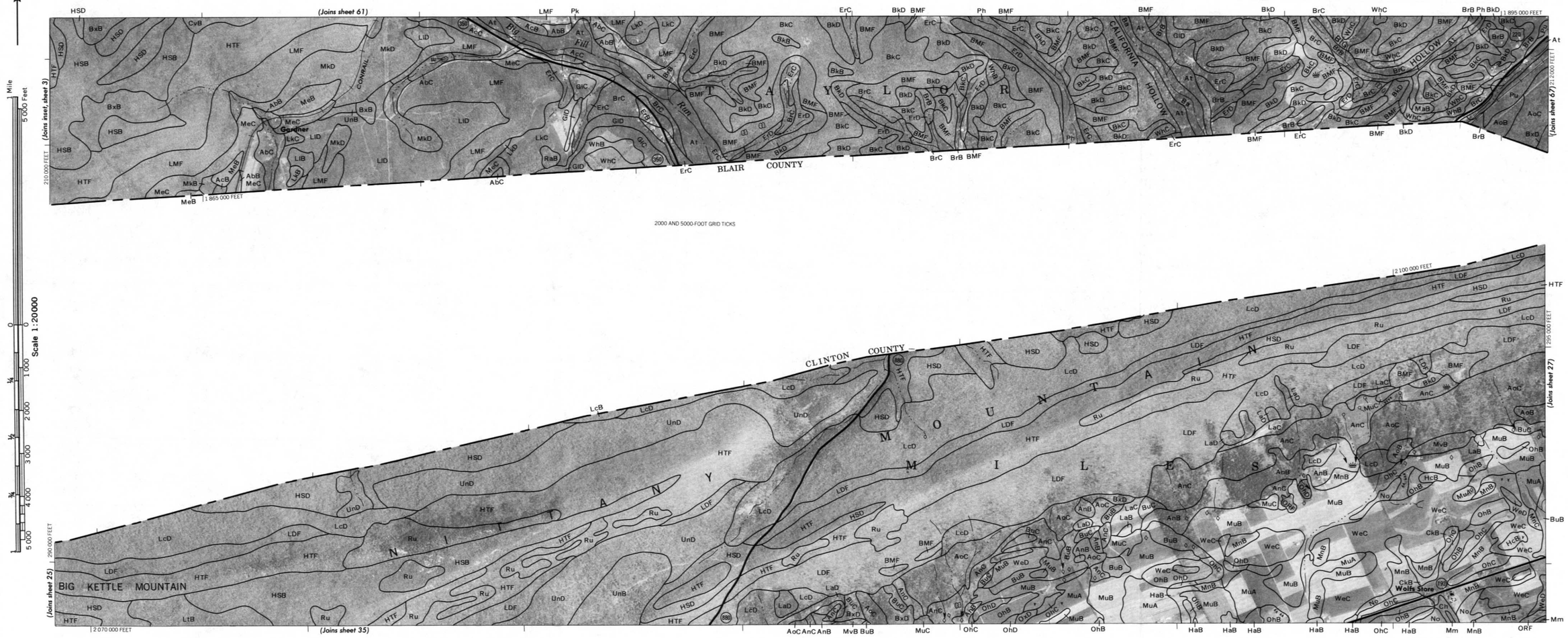
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

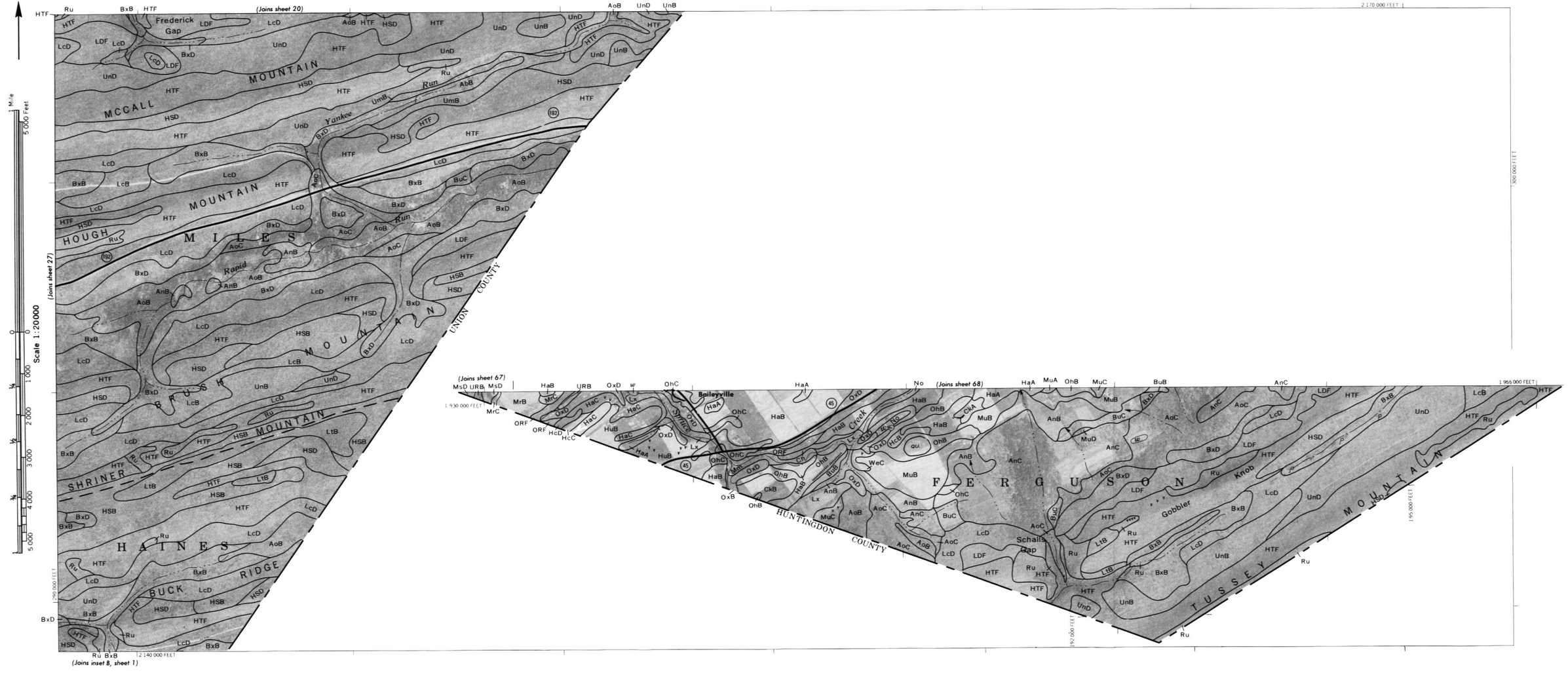


This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

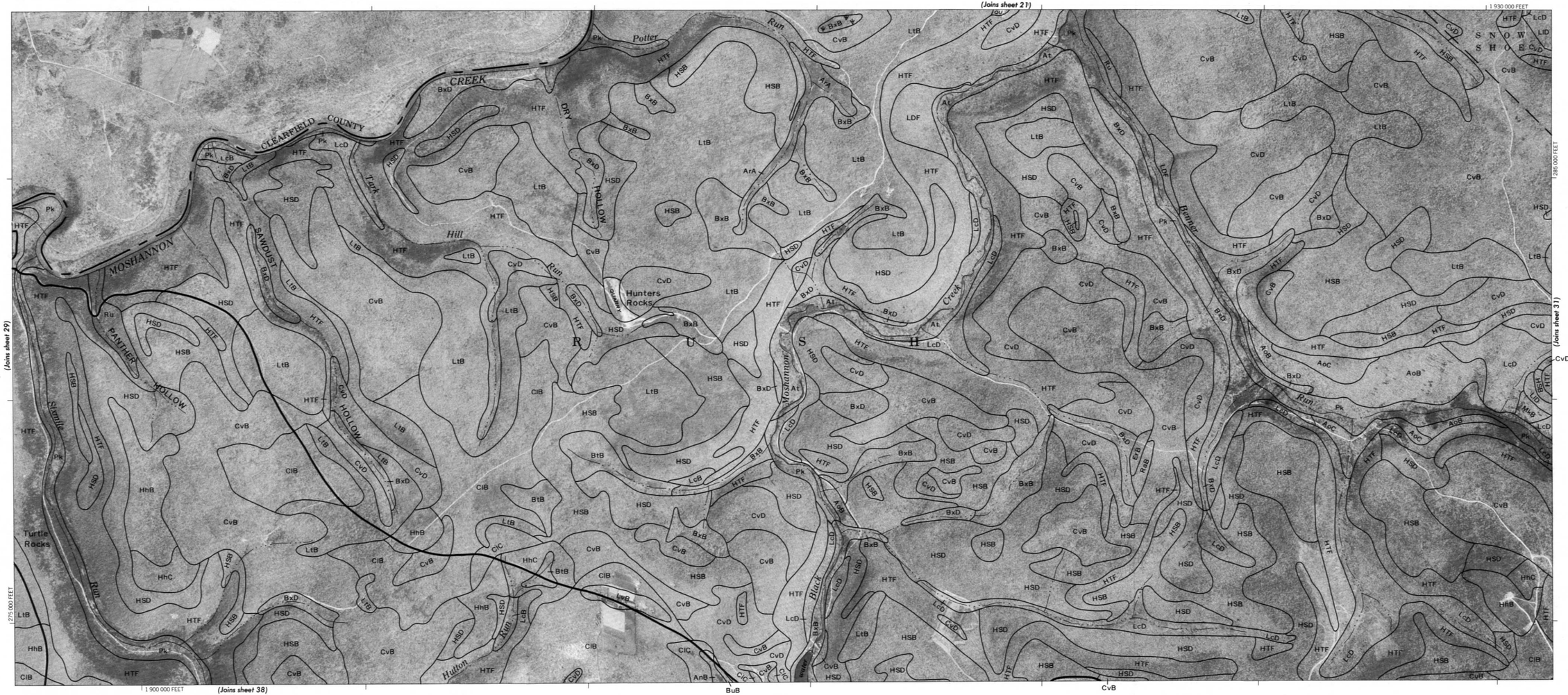
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners at intersections of approximately positioned





This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

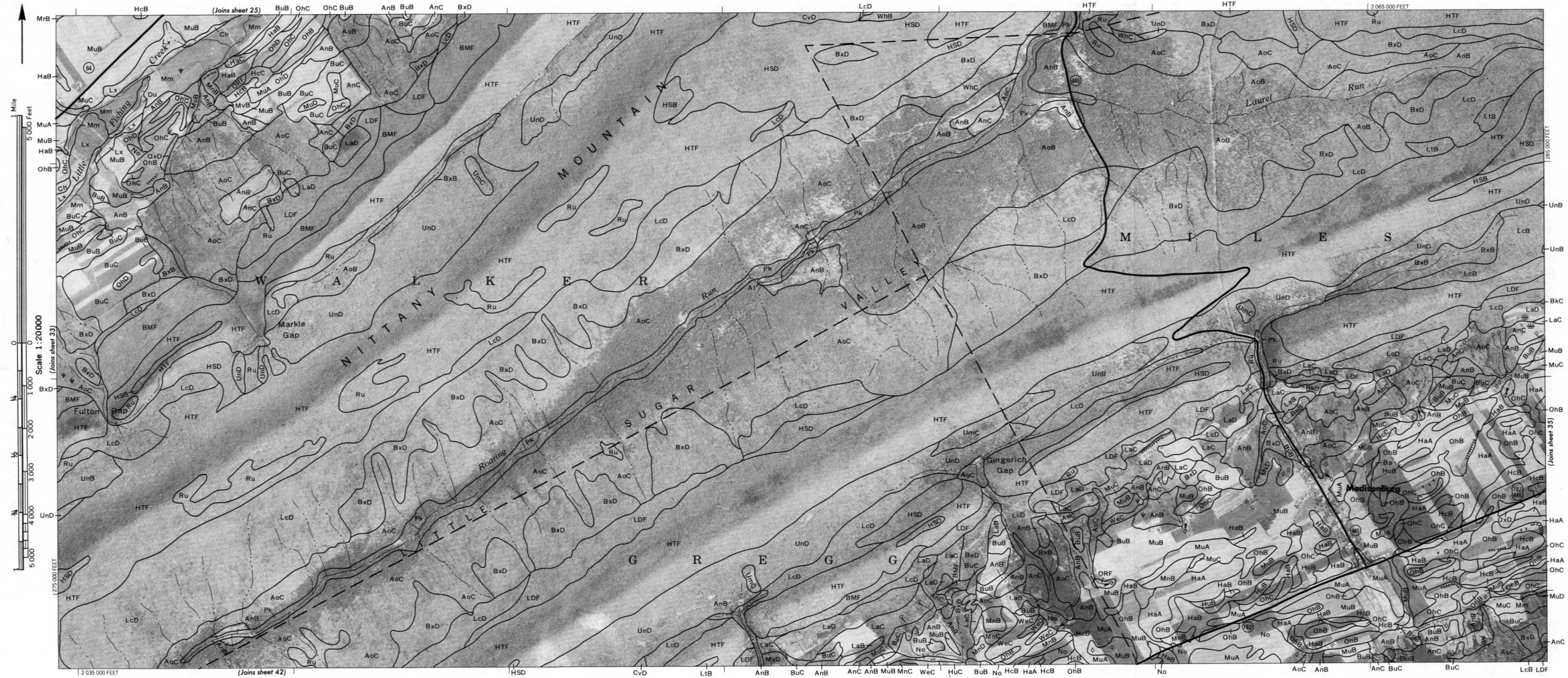


This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 32

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 34



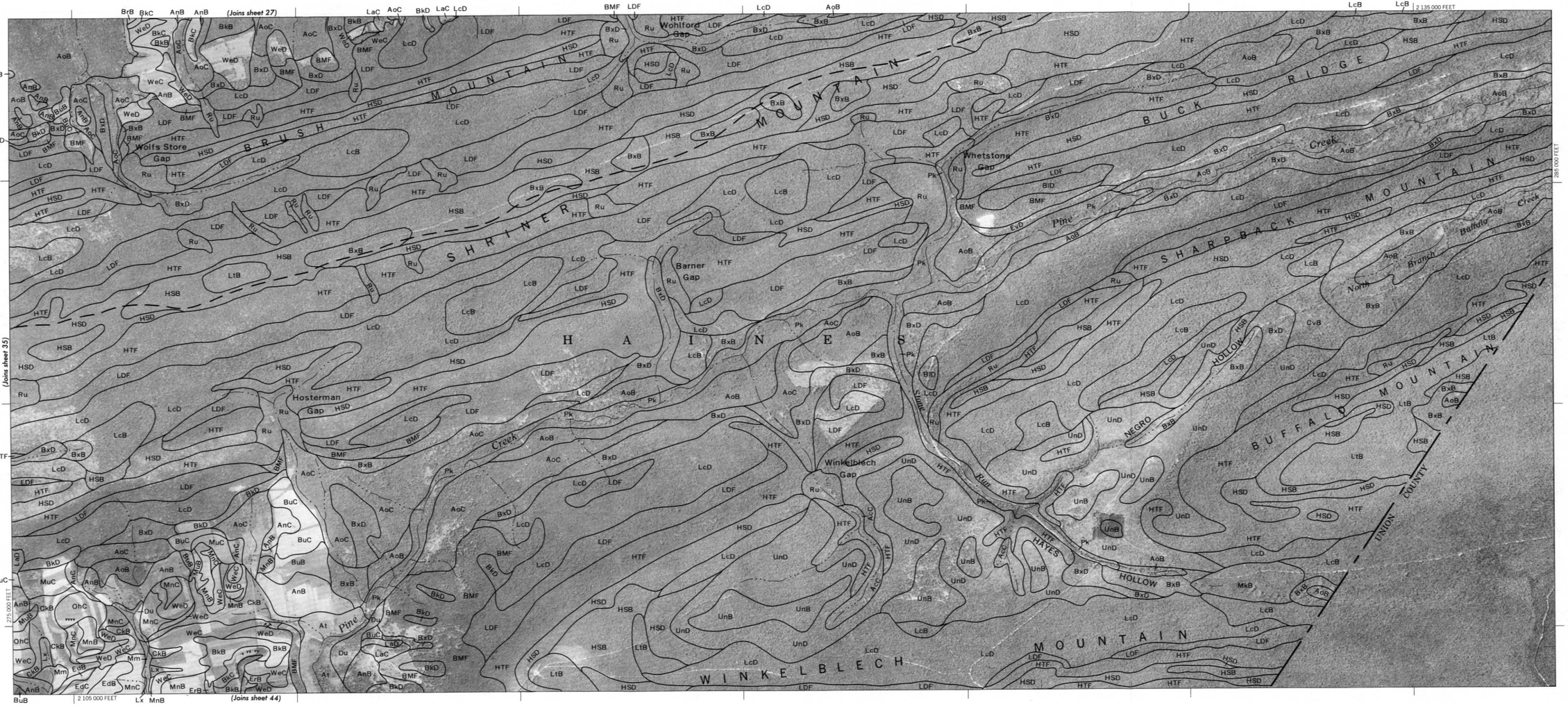
This map is compiled on 1977 U.S. Geological Survey Orthophotographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

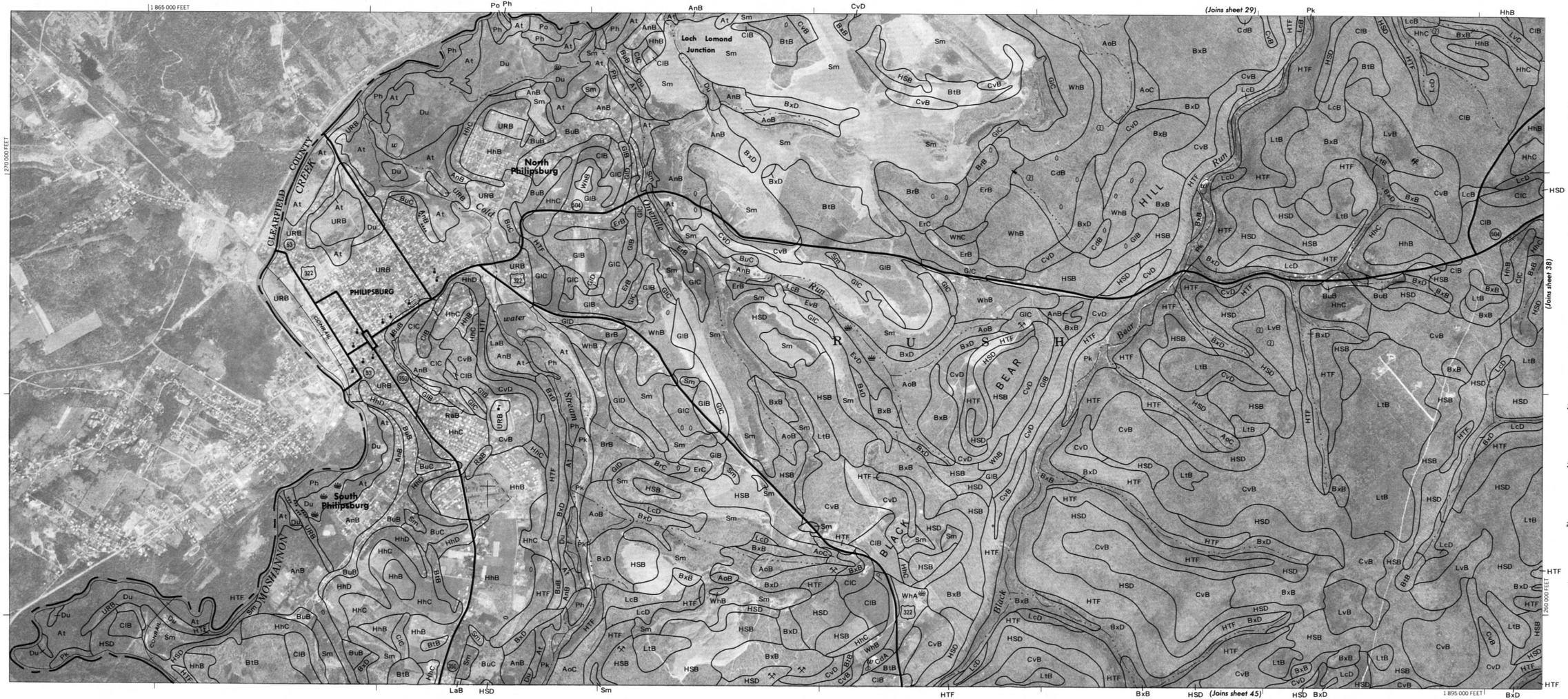
N

Scale 1:20000

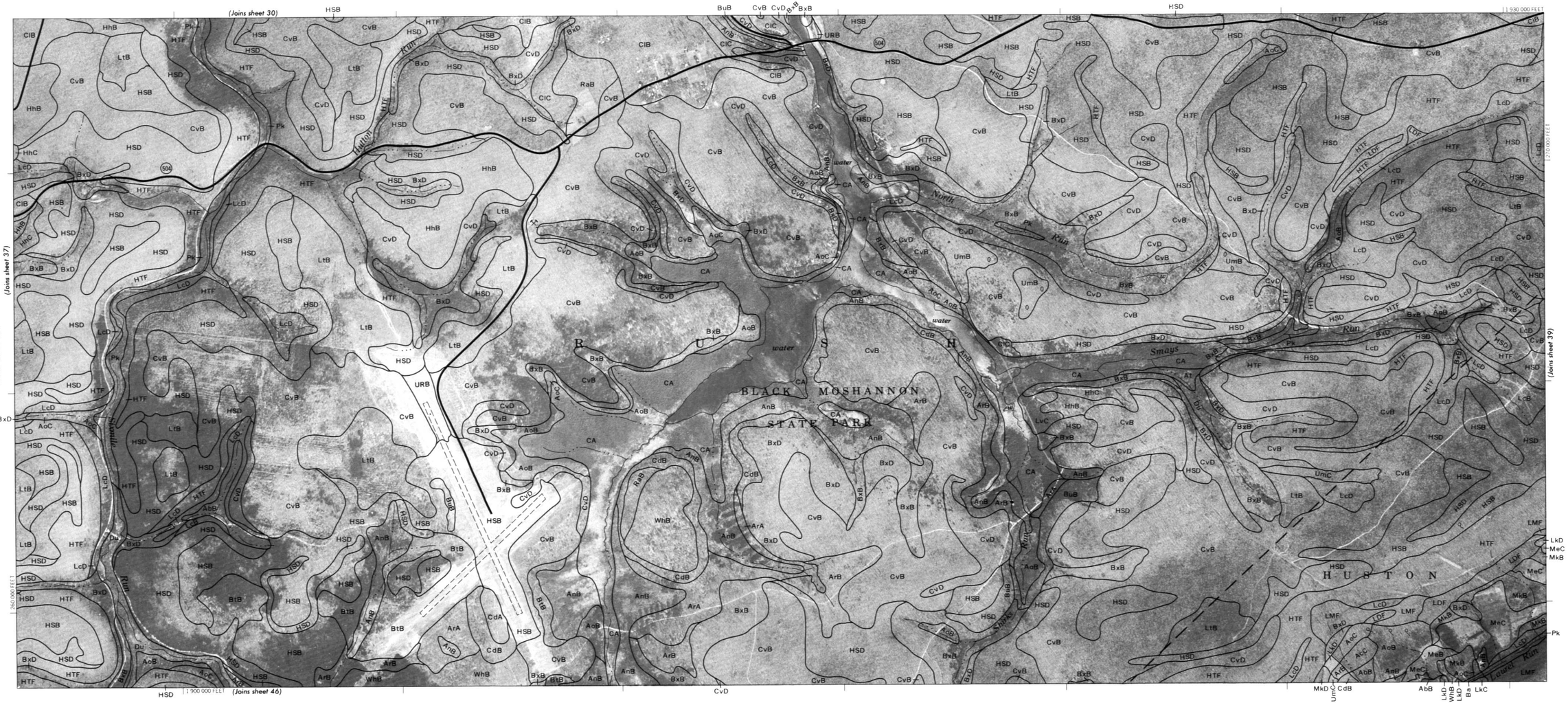
1 Mile
5 000 Feet
0
1/4
1 000
1/2
2 000
3/4
3 000
4 000
5 000

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 36

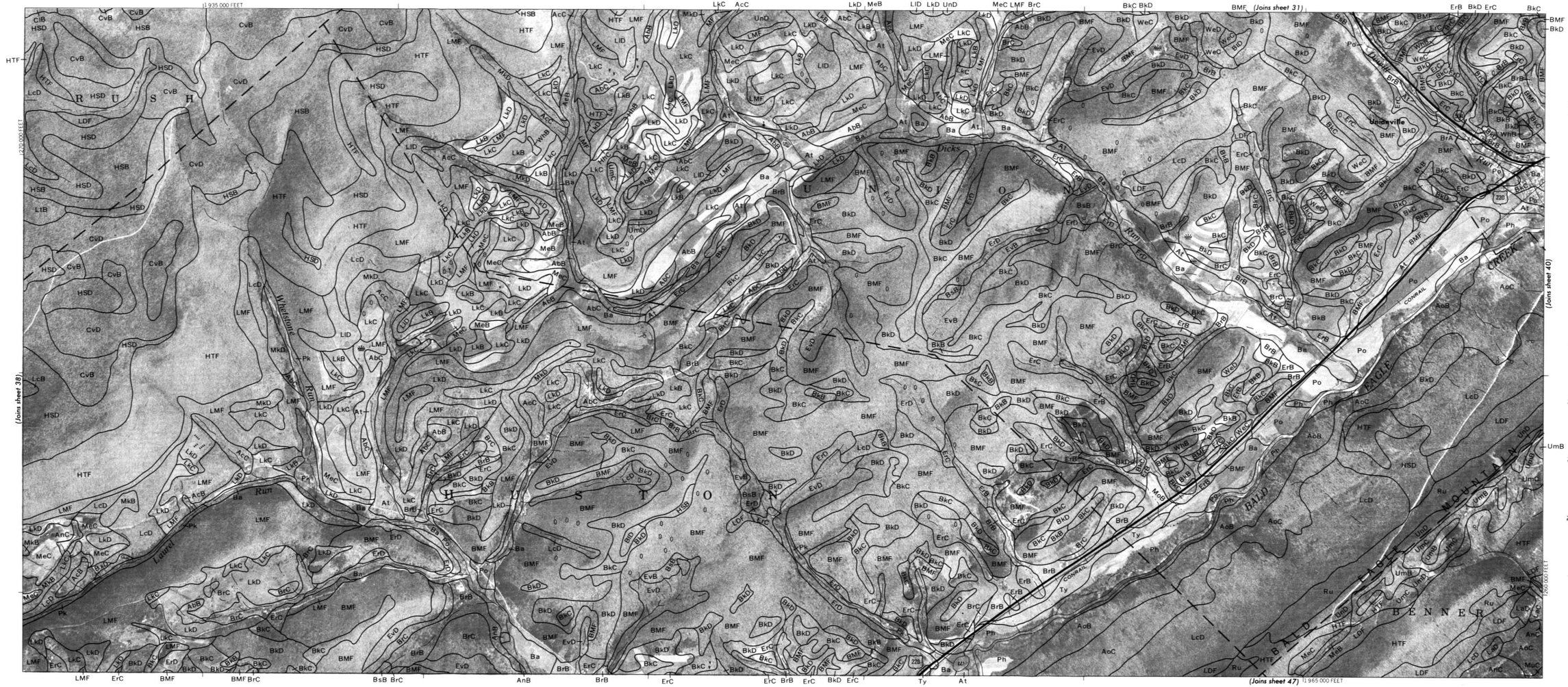




CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 38



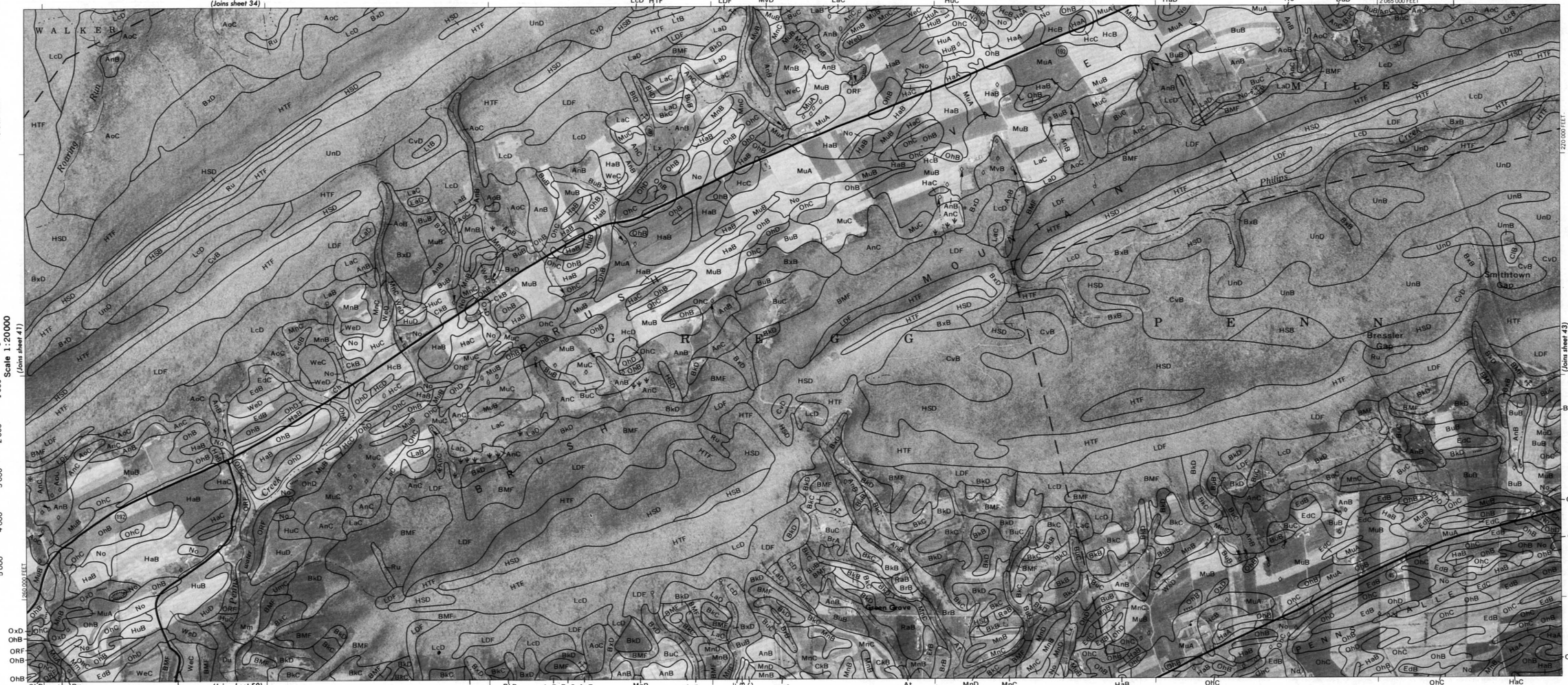
This map is compiled on 1977. U.S. Geological Survey Orthophotographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned



CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 40

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 42



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 43

43

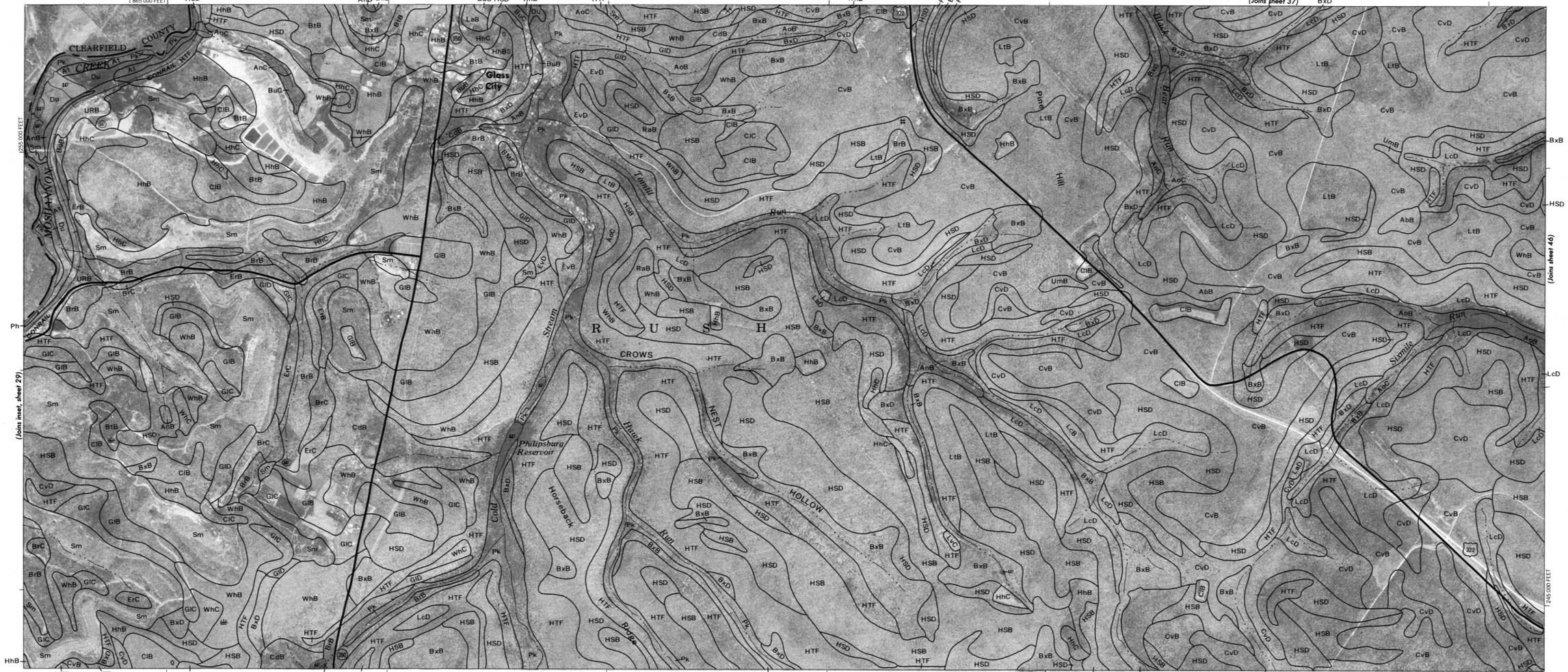
N

Scale 1:20000

1 Mile
5 000 Feet

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 44

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



45

N

Mile
5 000 Feet

Scale 1:20000

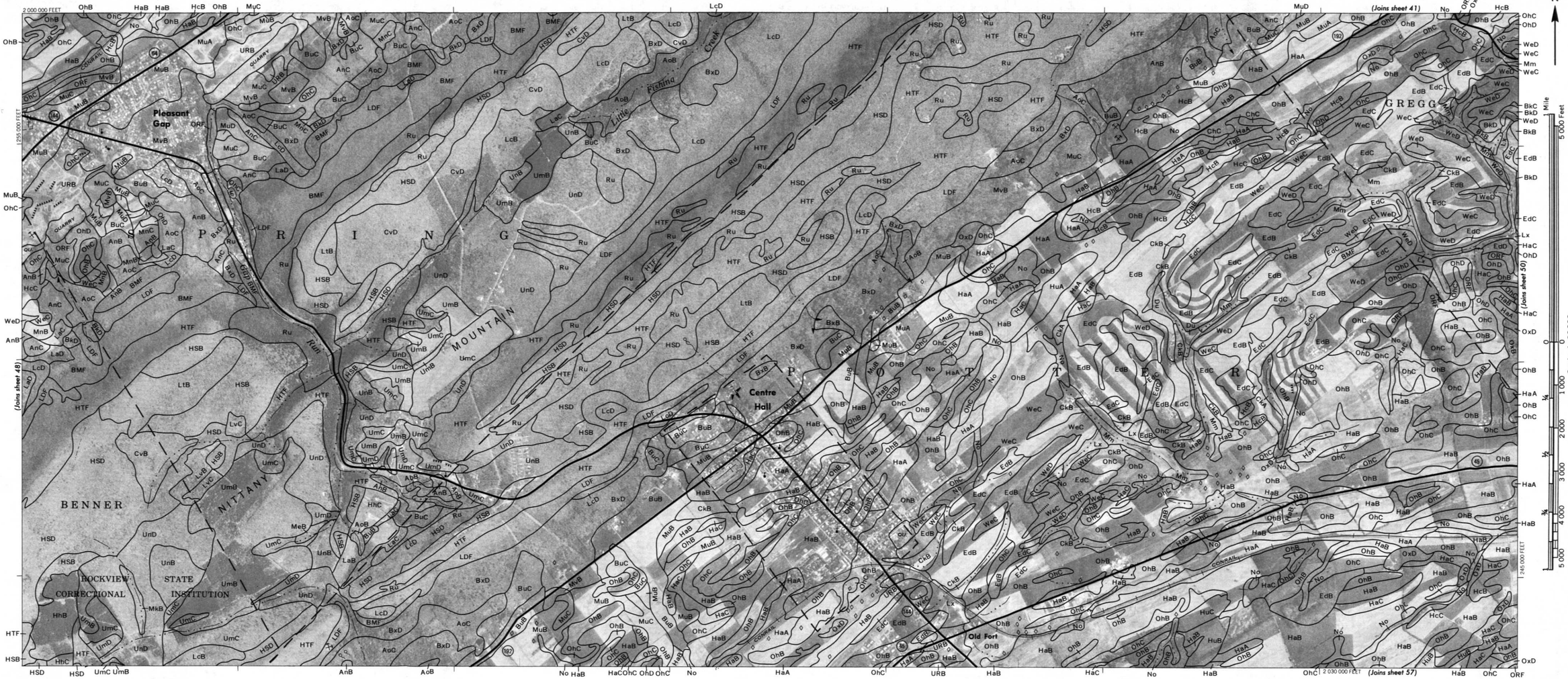
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 46

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 48

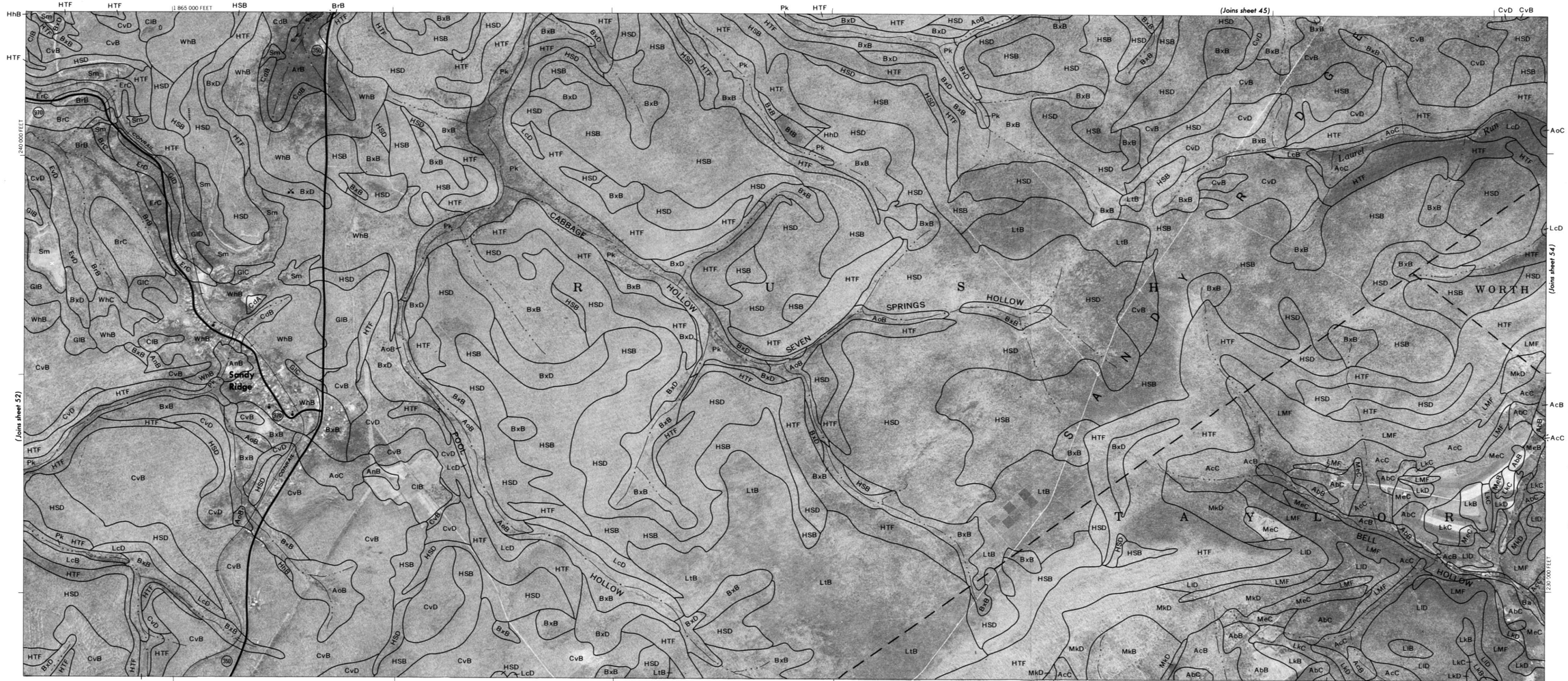
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



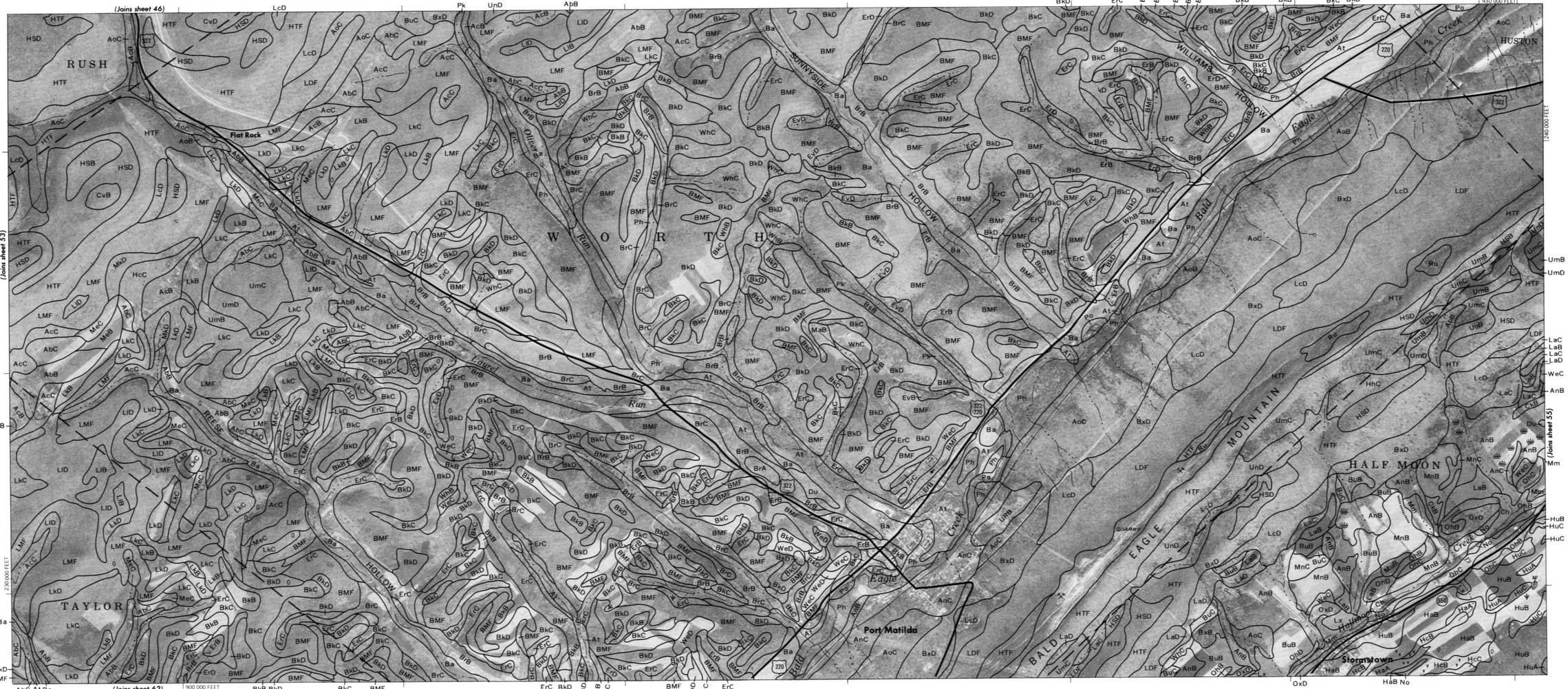
CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 50

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 54



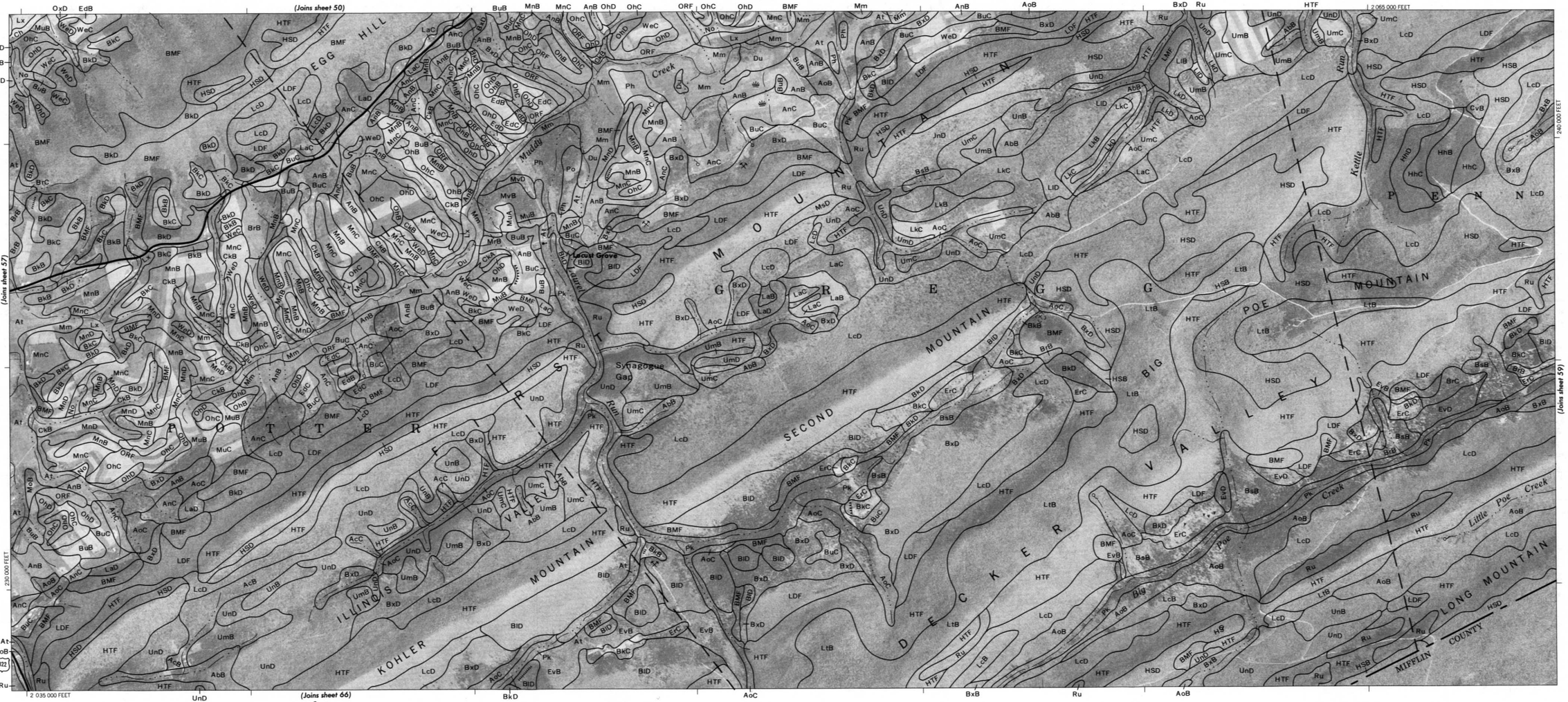
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid tracks sand land division corners, if shown, are approximately positioned.

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

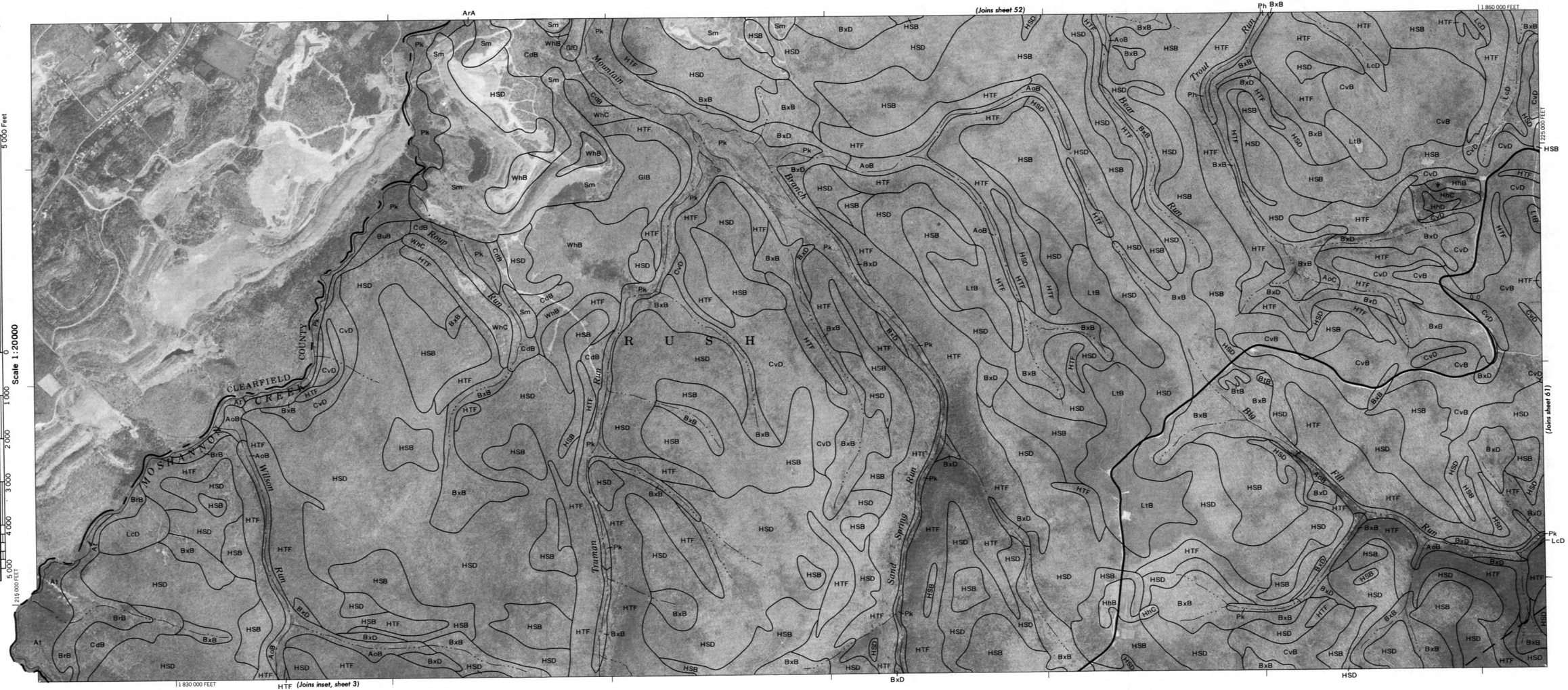
CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 57

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

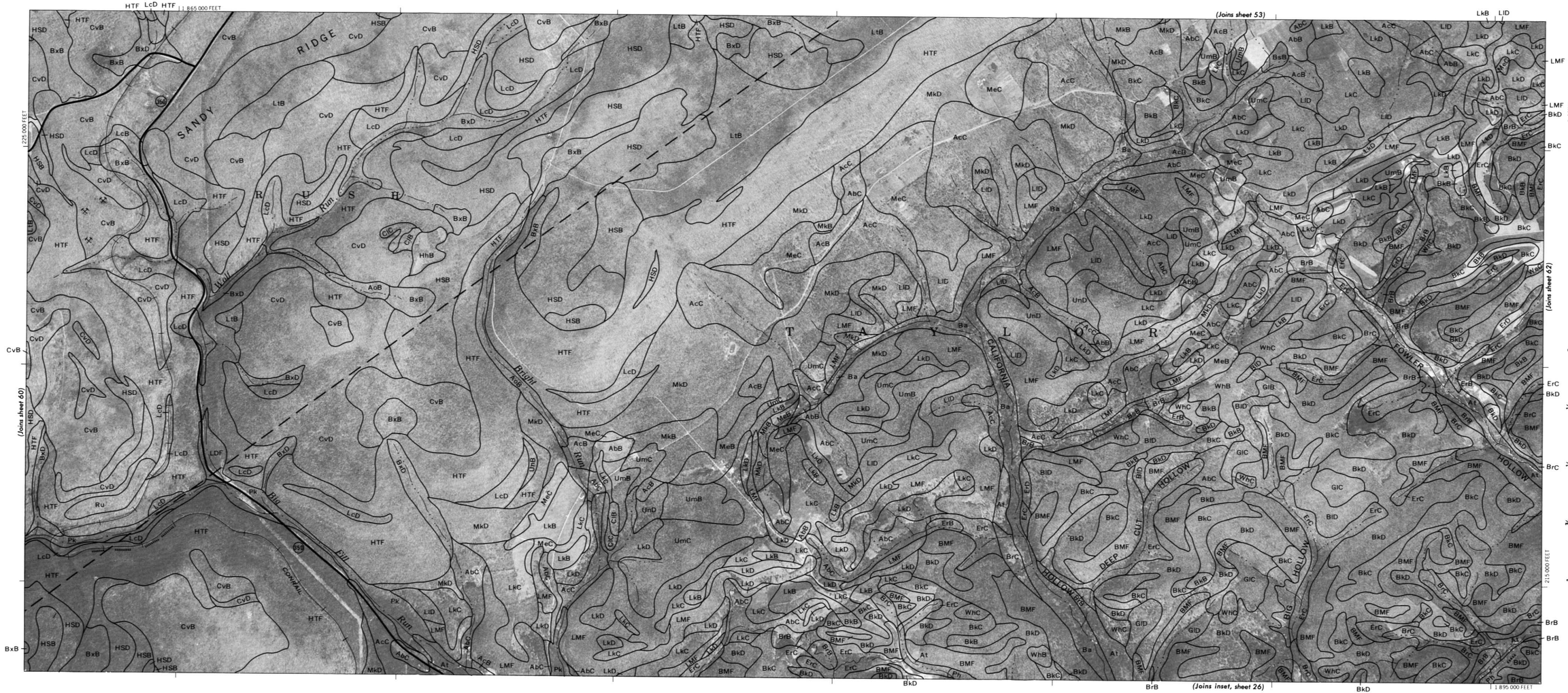
CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 58



This map is compiled on 1972 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1977. U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

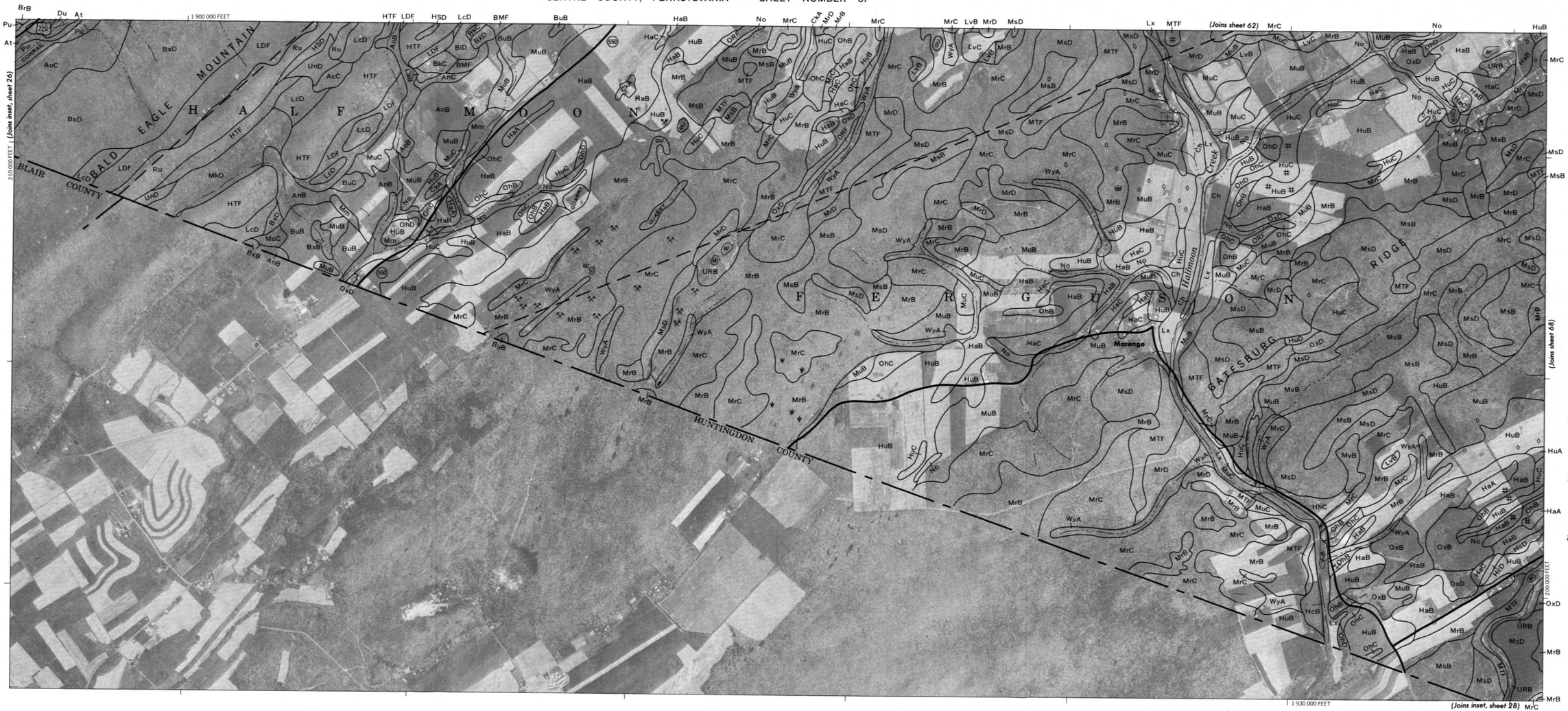
CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 64

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if known, are approximately positioned.

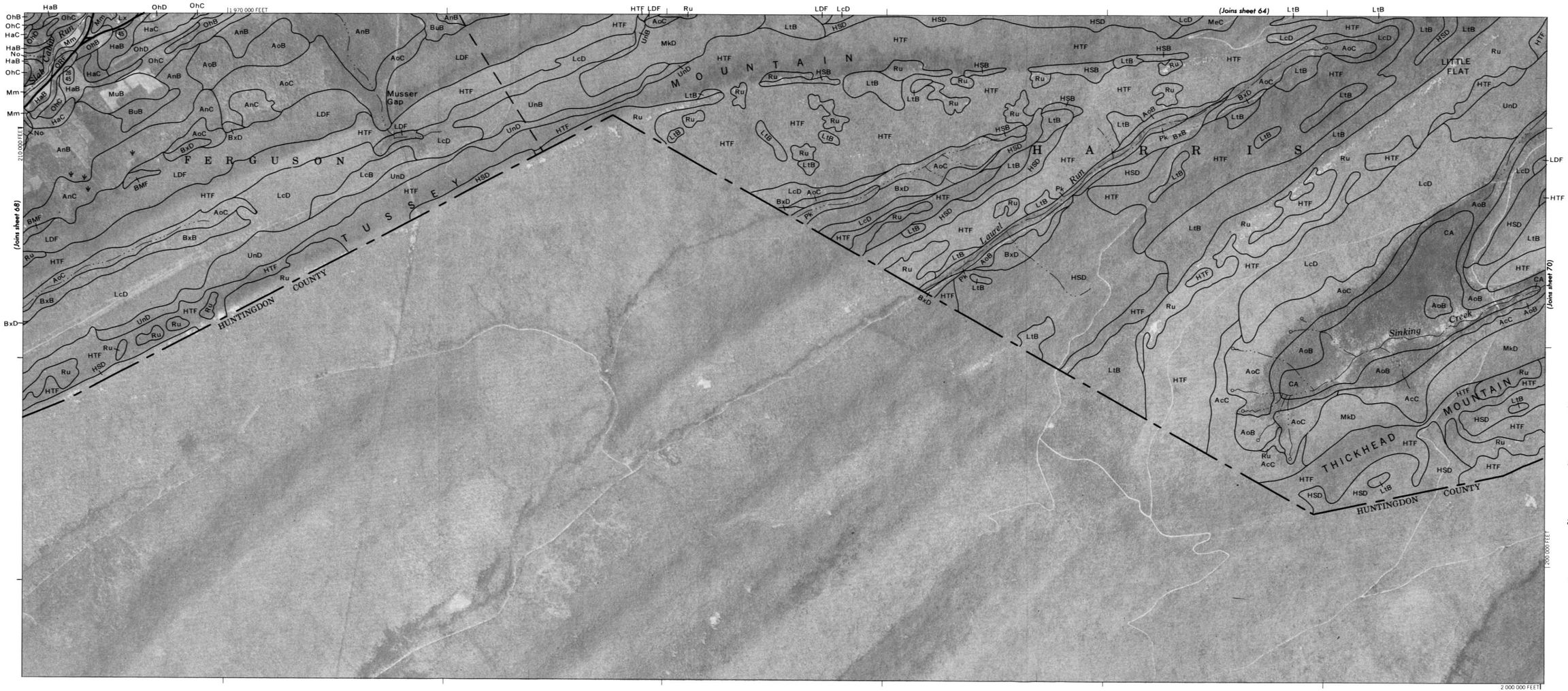
CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 66

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CENTRE COUNTY, PENNSYLVANIA — SHEET NUMBER 67



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.